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A REVISION OF THE NORTH AMERICAN SPECIES OF *OXYTROPIS* DC.

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Introduction

The review of the North American species of *Oxytropis* presented below had its origin in a less ambitious project. The species first to engage my attention were those native to the western United States, and I planned originally to limit my studies to the area west of the Great Divide and south of the Canadian border. It was already clear that accounts of the genus current in such floristic works as Rydberg's *Flora of the Rocky Mountains* failed in their primary purpose of making identification of specimens easy or even possible, a state of affairs confirmed by chaos on the shelves of many herbaria. The species listed seemed far to outnumber those existing in nature, while their names, as they had shifted back and forth in the past few decades between *Aragallus* and *Spiesia, Oxytropis* and *Astragalus,* had acquired an abundance of disordered synonyms. Several of the older binomials, imperfectly understood in the first instance, had assumed by accretion or altered emphasis connotations far removed from their respective original concepts, while a number more, lying fallow in the pages of periodicals, had never been evaluated in relation to their congeners. In recent years it has become impossible to determine from any published source either how many species occur in our western mountains or by what names they should properly be known.

As work progressed on the small group of Rocky Mountain and Great Basin species, it became necessary to examine much material of extralimital origin. For example, *O. viscida,* which ranges northward to Alaska and eastward in highly interrupted stations to Wisconsin and Quebec, cannot be adequately understood when viewed only in its western aspects. Similarly *O. deflexa,* a common cordilleran species, extends into the far Northwest, and in various forms through eastern and subarctic Asia, whereas the constellation of forms grouped below under *O. campestris* is merely a segment of a widely diffused boreal complex. Ultimately it was found that all but a handful of the New World species had thus been surveyed in some detail, and it seemed desirable and perhaps useful to include these few in the projected revision so as to gather together, for the first time since Asa Gray's tentative memoir of 1884, a record of the genus as it survives or flourishes on this continent.

Thus I have been led afield into regions where I have neither travelled nor collected and with whose flora and geography I am acquainted only by hearsay. As regards the Arctic species, except in a few instances where a contrary opinion seemed well grounded, I have accepted the conclusions of those better equipped by experience to pronounce judgment. I have felt justified in treating the species familiar to me in the West from a more critical point of view and it will be found that the varieties recognized within some of these are more finely drawn than elsewhere.

The taxonomic opinions presented below cannot in any sense be considered final. Even if the herbarium record were much more complete than it is at present, it is doubtful whether comparison of the external morphology of dried specimens, however careful or prolonged, will serve to illumine the problems of origin, variation, and interrelationship raised by what Gray justly called the "*species perdifficiles*" which comprise a great part of the genus. I shall feel satisfied, however, if some small progress towards definition of our major forms, and toward a stable and accepted nomenclature, has been achieved.

OUTLINE OF THE TAXONOMIC HISTORY

The occurrence of *Oxytropis* in America was first inferentially noted in 1800 by Simon Peter Pallas, who recorded from Labrador an astragalus resembling *A. montanus* L. (*O. montana* [L.] DC.); but when the genus was established by DeCandolle two years later, it was based exclusively on Old World species. Our first endemic species was discovered on the Missouri River by John Bradbury in 1811, and described shortly afterward as *O. Lambertii* Pursh. At the same time Pursh listed, under the mistaken label of *O. argentata* (Pall.) DC., a second species, encountered by Lewis and Clark in Montana, but many years were to elapse before this came to be recognized as a purely American type, the handsome *O. Besseyi.* In 1823 Richardson announced the first Canadian station for *O. deflexa,* previously known only from Asia; while *O. splendens* and several high boreal species still confused with *O. campestris* and *O. uralensis* were among the collections brought back by the Franklin Expedition. Meanwhile Nathaniel Wyeth had discovered in western Montana the remarkable *O. Lagopus,* described by Nuttall in 1834; and the same year saw the first synopsis of the American species in Flora Boreali-Americana. In this important work Hooker first characterized *O. splendens,* now better known from collections of David Douglas, the new *O. foliolosa* from Alberta, and a number of distinct races subordinated to *O. uralensis, O. arctica,* and *O. campestris* which, as yet known from all too scanty material, could not well be appreciated at their true value. The account of *Oxytropis* by Torrey and Gray in their Flora of North America (1838) followed that of Hooker in nearly all details, but derived additional luster from Nuttall's manuscripts, including the descriptions of six new species collected by the author on his transcontinental journey with Wyeth. These were the first American species to be described by a botanist who knew them in the field.

At this point the care of *Oxytropis* passed into the capable hands of Asa Gray and, with one exception, remained there until his death. Bunge, to be sure, put out a monograph of the entire genus in 1874, but his knowledge of the American species, derived from Gray's writings only meagerly supplemented by materials in European herbaria, was perforce limited; apart from a few valuable comments the work is of minor importance in our field. Gray published two papers on the genus. The first formed part of his revision of *Astragalus* in 1864, but here, although *O. podocarpa* was first described in the rank of species, the sixteen members of the genus (and additional varieties) previously accepted were reduced by half. The treatment reflects an extreme caution appropriate perhaps to the exiguous data at hand, and did little to advance an understanding of the species. An opportunity to compare the material of *Oxytropis* at Kew, in 1880, with his own rapidly accumulating collection enabled Gray to return to the genus with new insights and to resolve many difficulties, and the resulting synopsis of the genus in 1884 stands as a small but enduring monument to his genius. Sixty-odd years of exploration and collecting may have modified the outlines here and there, but have scarcely disturbed the basic specific concepts defined in this masterly revision.

The death of Gray in 1888 was felt by some contemporary botanists, especially in the West, as a liberation, and the turn of the century witnessed great activity not only in the field but in the proliferation of species, often hastily proposed. In 1899 Greene took up *Aragallus* Neck. as a substitute for *Oxytropis* (as also for *Spiesia* Neck., resurrected shortly before by Otto Kuntze), and Aven Nelson, whose interest in the genus was to continue for many years, published an important paper on the species known to him in Wyoming and the Rocky Mountains. In 1905 Greene, hitherto content with combining the older epithets in *Aragallus,* proposed nineteen critical species, each based on one or two specimens only, but these have nearly all fallen into disrepute. About the same time Rydberg, in occasional papers and floras spaced over a period of three decades, began to contribute novelties or new definitions, thereby adding more to the literature and synonymy than to a true understanding of the genus. Rydberg's work on *Oxytropis,* which was to have culminated in a monograph for the North American Flora, was cut short by his death in 1931. In 1928 St. John published a revision of a small group of species native to the state of Washington, and quite recently C. L. Porter, an active student of *Oxytropis* in the Rocky Mountain states, discovered and described the rare and peculiar *O. obnapiformis.* It is curious that Marcus Jones, who devoted so many years to *Astragalus,* evinced almost no interest in the related *Oxytropis;* it may be surmised that he found Gray's classic paper adequate.

During the post-Grayan period the *Oxytropis* species of the Northeast and of the Arctic received comparatively little attention from botanists. In 1894 Britton described the remarkable *O. Belli* from Hudson Bay, and the Amundsen expedition brought back *O. Roaldi* from the Yukon coast in 1906, but nothing much of a critical nature found its way into print until Fernald's paper of 1928. Although primarily concerned with *Oxytropis* in the Northeast, Fernald discussed several extralimital problems, and his short treatise stands comparison for novelty and interest only with Gray's revision of 1884. In the last few years the work of Polunin, Hultén, and Porsild has greatly enriched our knowledge of the genus in high latitudes and brought to light two marked Alaskan species.

The allusion above to a projected monograph by Rydberg is based on the fact that the genus was keyed out in North American Flora, 24: 262, 1929, and a summary discussion of the *Oxytropis* versus *Aragallus* controversy published during the following year (in Amer. Jour. Bot., 17: 236–238). The material at the New York Botanical Garden is fully annotated in Rydberg's hand and several unpublished species thereby indicated, but Dr. Gleason assures me that no manuscript was found among Rydberg's papers. Perhaps it is not altogether unfortunate that the monograph was never written, since Rydberg himself stated, in the paper just referred to, that the genus contained "about 70 North American species," a much greater total than anyone, I think, is likely to concede today. The present treatment maintains only twenty-two major species which, with twenty-one additional minor taxa such as were customarily accepted by Rydberg as species of the first rank, brings the roll call for America to forty-three.

VALIDITY OF THE GENUS

The status of *Oxytropis* as a genus distinct from *Astragalus* has been argued for more than a century and unanimous decision is still to be reached. Systematists in favor of reducing *Oxytropis* to subgeneric rank have not seriously questioned the naturalness of the group or its presumed monophyletic origin, but have pointed to the lack of a distinctive habit and of absolute criteria by which the two genera can be set apart. Their opponents, no doubt dreading the changes in nomenclature brought about by wholesale transfers from *Oxytropis* to the older genus, have stressed the advantages of maintaining an old and honored generic concept.

It is a truism that no genus can be defined or fully described until the last surviving member has been made known, and when DeCandolle erected *Oxytropis* to contain a part of the Linnaean *Astragalus,* he could scarcely foresee the number or variety of species which subsequent exploration would bring to light. Yet since *Oxytropis* was founded in 1802, only two species have turned up to challenge the original characterization. As first set forth, *Oxytropis* was characterized by the beaked keel-petals and the introflexion of the pod's ventral suture, as opposed to the muticous keel of *Phaca* and *Astragalus,* with their pods unilocular or bilocular (from the dorsal suture) respectively. The reduction by Gray of *Phaca* to *Astragalus,* almost everywhere admitted as inevitable, and the discovery of a vast number of new species in the genus so formed, allowed in *Astragalus* an extreme diversity in structure of the legume, and it then became impossible in practice to distinguish *all* species of *Oxytropis* on technical features of the pod. Only the beaked keel, certainly a poor character in the order, remained, and this was further shaken by the description of two perfect astragali, *A. nothoxys* Gray and *A. acutirostris* Wats., with distinctly cuspidate keel. As early as 1827 Sprengel (Syst., 4^2.), without discussing the merits of DeCandolle's genus, summarily transferred a number of species back to *Astragalus,* and Baillon (Hist. Pl., 2: 281, footnote 8, 1870) cast further doubt on the validity of *Oxytropis.* Subsequently Rouy (Fl. France, 4: 186, 1897), quoting the "oxytropoid" astragali described by Gray and Watson, removed all the French species of *Oxytropis* into a subgenus of *Astragalus.* Similar arguments were advanced by Hegi (Ill. Fl. Mittel-Eur., 4: 1403, 1923) and by Wheeler (Leafl. West. Bot., 2: 209, 1939). It should be borne in mind that Bunge, the monographer of Old World *Astragalus* and of *Oxytropis,* Taubert (in Engler's Pflanzenfamilien), as well as Gray, Bentham and Hooker, Dalla Torre and Harms, and a host of others have supported *Oxytropis,* as do the majority of contemporary botanists.

If the character made the genus, the existence of a beaked keel in *Astragalus nothoxys* (even though absent in some individual plants of the species; cf. *Hamosa Gooddingii* Rydb.) would go far to invalidate *Oxytropis* as a natural genus, for this is an undoubted *Astragalus,* closely related to congeners with muticous keel native to the same region, and having a pod wholly at variance with anything known in *Oxytropis.* An approach from this angle is fundamentally mistaken. A genus is perceived by the sum of characters common to its members, not by one or two which may prove unique to it and thereby become of practical use in a key. The gift of speech is a character of *Homo,* but a dumb man is not classified with the monkeys. The so-called ''oxytropoid'' astragali can in no sense be said to bridge the gap between their genus and *Oxytropis* and are no real obstacle to recognition of the latter.

The controversy cannot be settled out of hand and an opinion that is not based on profound knowledge of both genera in all their ramifications is not worth the trouble of expression. Evidence much more compelling than a superficial resemblance in habit or properties between *A. alpinus* and *O. foliolosa* in the Rocky Mountains and between *A. mollissimus* and *O. Lambertii* on the Western Plains (as adduced by Wheeler, 1939) must be presented before the case against *Oxytropis* can be satisfactorily proven. Until it can be shown that the gap between the two genera is at some point no greater than that existing between species-groups within *Astragalus* as generally received, that there are species referable with equal justice to either genus, or that *Oxytropis* is of itself polyphyletic and derived from several strains of a hypothetical ''*Proto-Astragalus,*'' the submergence of *Oxytropis* in the uncharted ocean of the older genus will do nothing to clarify relationships or promote a stable nomenclature in the Astragalanae.

There is a leaf character, so far as can be discovered not mentioned in the literature, which may perhaps provide an additional criterion for the genus. The leaflets in all species of *Oxytropis* familiar to the writer are decidedly inequilateral at the base or, when so narrow that the asymmetry becomes obscure at the insertion of the petiolule, they are introrsely falcate, the lower margin being longer than the upper (leading) edge, presumably composed of larger or more numerous cells. In some individual leaves, or in the leaves of some individual plants, the asymmetry is admittedly almost imperceptible, but has been found clearly expressed in some specimens of every species examined in connection with this paper, and seems to be at least latent throughout the genus. No trace of asymmetry has been seen in the leaflets of any genuine species of *Astragalus.* Whether ultimately significant or not, the point is worth systematic investigation.

Phylogeny and Infrageneric Divisions

Bunge's monograph (1874) postulated four subgenera in *Oxytropis. Ptiloxytropis* (of Turkestan) and *Physoxytropis* (the American *O. multiceps)* were each based on a single species characterized by a small legume enclosed by the unruptured calyx. The remaining (179) species, with pod at length exserted from the broken calyx, were distributed between *Phacoxytropis,* with no septum in the pod, and *Euoxytropis,* with pod always ventrally and sometimes also dorsally septate. Only one American species, *O. deflexa,* was admitted to *Phacoxytropis,* and thus all but two of ours fell into the last subgenus. This was further broken up into thirteen sections marked by peculiarities of vesture, fruit-structure, and arrangment of the leaflets along the rachis, six of them being represented in this continent. Gray's second revision (1884) established four sections: *Calycophysae* (= *Physoxytropis), Montanae* (= *Phacoxytropis), Campestres,* and *Physocarpae* (= parts of *Euoxytropis).* Similarly Rydberg, in 1917, separated *Aragallus* of the Rocky Mountains and adjacent plains into six series: *Deflexi* (= *Montanae* Gray), *Nani* (= *Physoxytropis* Bge., enlarged), and four others more or less corresponding to some of Bunge's sections of *Euoxytropis.* While there is something to be said in favor of each of these neat arrangements, they fall short of a natural classification in that they contrive to separate, by undue emphasis on a single character, pairs of closely allied species, and at the same time claim no greater diversity between sections than between species within a section. Delimitation of infrageneric groups should not, of course, be attempted without a firm grasp of the genus as a whole, and lies beyond the scope of this paper. It seems wise to adopt no sectional groupings for the New World species until they have been fully correlated with their Asiatic congeners.

It is impossible, nevertheless, to survey even a segment of the genus without becoming aware that several fairly distinct groups exist, even if their evaluation is not possible at present. The species like *O. deflexa,* numerous in Asia, with their strong tendency to caulescence, stipules free from the petiole (but sometimes connate opposite the petiole), and pendulous pods, stand well apart from the rest. Both morphologically and in their preference for mesophytic habitats, these may represent a primitive line of development in the genus, and rather closely resemble some evidently primitive astragali. The arctic and alpine *O. nigrescens, Scammaniana* and *Mertensiana* (of § *Arctobia* Bge.), and *O. podocarpa* (of § *Caeciabia* Bge., differing in the stipitate pod) form an evidently related group, much alike in habit, stipule, few-flowered raceme, and other details. The center of their distribution lies in the Behringian region, although *O. podocarpa* ranges southward in the Rocky Mountains and recurs as a relict in Labrador and Baffin. In this alliance the branches of the caudex have a potential ability, not infrequently arrested in the individual plant, to elongate over a period of years, at length achieving a loosely matted rather than cespitose-acaulescent habit. The eglandular species with pseudo-verticillate leaflets (§ *Baicalia* [Stell.] Bge.) fall inevitably together, but the disposition of the leaflets is hardly a fundamental character. Our two species constantly so characterized, *O. splendens* and *O. Belli,* are no doubt related to each other, but *O. arctica,* with leaflets normally solitary but occasionally with a few disposed in pairs, closely approaches *O. Belli* in its fragile stipules and in the structure of the flower and pod. So also "*O. varians,*" with leaflets verticillate in variable degree, at the same time makes so close an approach to some forms of *O. campestris,* that it is here treated as part of that complex. Hultén has shown (Fl. Kamtchat., 3:103) that seeds of *O. erecta* Kom., a species of the *O. campestris* type with scattered leaflets, produced in cultivation plants with partly paired or verticillate leaflets. Hybridization may, however, play its part in this situation.

The glandular species of *Oxytropis* are commonly arranged in two series, one with verticillate (§ *Polyadena* Bge.), the other with scattered leaflets (§ *Gloeocephala* Bge.). Our sole representative of the glandular species, the polymorphic *O. viscida,* not only breaks down the distinction between Bunge's two sections by producing an occasional plant with numerous paired leaflets, at least in the mature secondary leaves, but so closely resembles forms of *O. campestris,* so readily hybridizes with that species, and varies in so nearly parallel a fashion, that a near affinity between the two can scarcely be doubted. In fact viscidity and its absence and both paired and solitary leaflets occur in each of the four possible combinations in species alike as to floral and carpological structures, and segregation of each series as a section tends to obscure rather than clarify the relationship between them.

The remaining American species, although they exhibit remarkable modification in the fruit, are similarly interrelated, and it is difficult to draw any but vague lines between them. The essentially boreal constellation of forms centering around *O. campestris* presents a basic pattern from which the rest, as they have migrated southward in times past into the diverse soils and climates of the Western plains and mountains, are most probably derived. In *Astragalus,* xerophytic conditions favor the development of exceptionally large, small, or otherwise diversified pods, and an analogous though less extreme modification is found in our species of *Oxytropis.* The valves of the pod in *O. Besseyi, O. obnapiformis, O. Lagopus,* and *O. multiceps* tend toward a papery and inflated state, while those of *O. Lambertii, O. sericea,* and *O. nana* are of tough texture and more closely invest the seeds. In each of these series reduction in size culminates in a pod so small that at maturity it remains enveloped by the unbroken calyx and the calyx itself becomes somewhat inflated and bladdery. When Nuttall discovered the extreme example of this sort in *O. multiceps,* he proposed for it a new genus, *Physocalyx,* and Bunge's subgenus *Physoxytropis* was based on the same. Rydberg's *Nani,* with the same character, took in *O. Lagopus* and *O. nana,* but the latter is doubtfully best referred there. In the series with thin-walled pod the pedicels (nearly always) become jointed to the axis of the raceme and the calyx and fruit fall together, sometimes before dehiscence. The pedicels of *O. nana* remain, as in *O. sericea,* firmly attached in fruit, and these two species appear closely related in other ways. It is possible that the *"Physocalyx"* condition has arisen as the end-product of two[1] separate lines, a fact which makes it unsatisfactory as a sectional character.

Finally we have a pair of small-flowered species, *O. Parryi* and *O. oreophila* (with a local satellite or derivative in *O. Jonesii* which can be considered with them), distributed around and within the Great Basin. They are much alike in facies, though the former has coriaceous and the latter membranous and inflated pods. They may be interpreted either as directly related, and then as forming a somewhat disjunct group of their own, or perhaps more correctly as parallel derivatives of the two principal series outlined above. Rydberg created a monotypic section for *O. Parryi,* perhaps justifiably, but placed *O. oreophila* with *O. podocarpa,* a certainly mistaken arrangement.

A hypothetical view of affinities in our species is presented diagrammatically in figure 1.

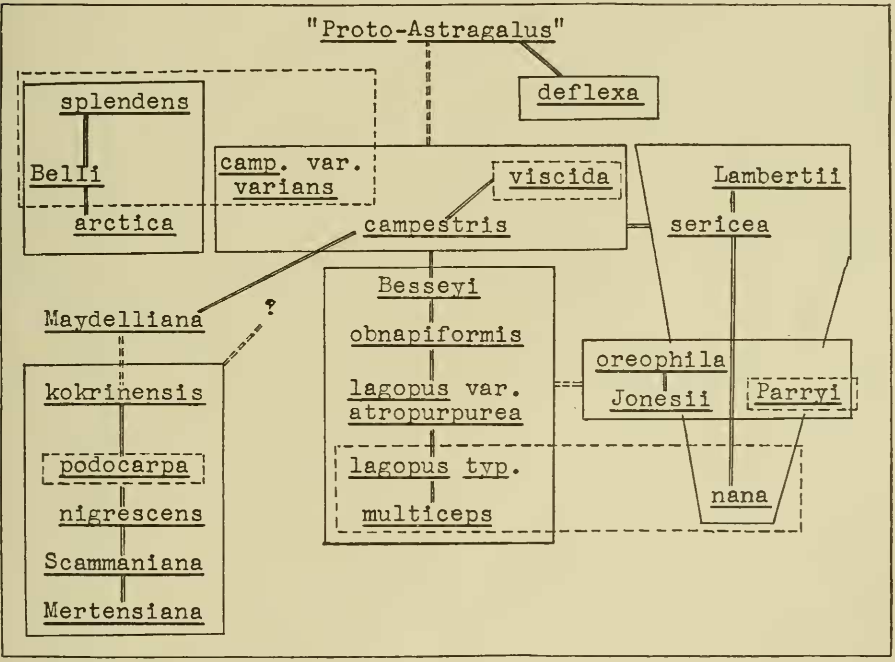

Figure 1. Hypothetical view of relationships in American species of *Oxytropis.* Solid lines enclose apparently well-marked groups; broken lines those species formerly included by authors in what are thought to be unnatural or insufficiently definite sections. Solid double lines indicate close relationship between groups or individual species; broken double lines less certain and doubtful affinities.

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[1] The Siberian *O. includens* N. Basil., sole representative of § *Angarida* Vass., seems to be a third, independent but parallel development; cf. Fl. U.R.S.S., 13:542, 1948.

Criteria

Variation within the species is so general in *Oxytropis* as to acquire almost the status of a generic character. Failure to appreciate the degree and direction of this inherent variability, often strikingly great, has led to a multiplication of supposed species and, as an inevitable sequel, has given the genus a reputation for difficulty only partly deserved. The principal unstable characters, and those which have been found useful for the purposes of classification during the present study, are as follows:

Stature. The repeated emergence in *Oxytropis* of pygmy and giant phases, noted in more detail in the ensuing pages, is a remarkable phenomenon in a perennial genus, especially when, as here, reduction or the reverse often extends not only to size of the plant-body but to the reproductive organs. Field experience suggests that these variations in size are to some degree inherited, not merely or at least not always expressions of season, site, or habitat. For example, Victorin and Rousseau (Cont. Inst. Bot. Univ. Montreal, 30: 32, 1940) report that plants of typical *O. johannensis (O. campestris* var. of this paper) and of their fma. *bicensis,* described as a dwarf race with short pod, maintained their differences when grown side by side in the garden, even to the extent of flowering at different periods. It seems probable that each species consists of several or many small races differing slightly in genetic constitution but experimental evidence on this point is still lacking. For the moment it is only possible to point out some of the more outstanding cases as expressed in the external morphology of the plants, remarking that these seem to occur for the most part in no more than sporadic fashion here and there in the range of their species, with intermediate states more common than the extremes. Occasionally a dwarf or giant race is supported by other characters or found to occupy a distinct area of its own, and these have been maintained as varieties.

Pubescence. The type of vesture clothing the herbage is usually uniform in the species but its density is variable, probably linked with edaphic factors. As a whole, however, the sorts of trichomes are too much alike to furnish valuable diagnostic characters. The two-armed (dolabriform or malpighian) hairs of *O. Lambertii* are an obvious exception. Hairs in the inflorescence, including the calyx and upper portion of the peduncle, are commonly of two sorts, one longer, with a tendency to be spreading and pale in color, and the other shorter, more nearly appressed and fuscous. The proportion in which the two sorts are mixed varies independently of other characters, and in the same species either sort may be absent, either predominant, or each may be of either color. In rare cases a particular combination has been found to possess some vague geographic correlation, but the rule is for widely divergent states to occur promiscuously and in close proximity.

Stipules. The importance attached to minute stipular characters by some students of the genus has been, I think, overestimated. On a single stem the stipules generally differ somewhat according to position in the year's cycle of growth, those of the resting or winter leaves being shorter, with shorter free blades, than the rest, and showing tendencies toward denser vesture and simpler venation. Similar differences, especially in the length of the blades, are often found in the same colony, and individuals with exceptionally long blades, often echoed above by elongated bracts, are common in the genus. Nevertheless the texture of the stipules, whether thin and fragile, firmly scarious, or stiff and papery, is characteristic and of great value. The presence or absence of bristly cilia on the margins of the blades is of occasional help in confirming an identification but neither state is invariable in any species. In a few boreal members of the genus some of these cilia are shortened and thickened into the form of clavate processes, and this seems to be quite often a specific character. It has been generally overlooked that the stipules in most of our acaulescent species are not only adnate to the petiole but strongly connate opposite it, in vernation forming a closed cylindric sheath, but this becomes so early ruptured by pressure of growth from within that it can be seen only by dissection of the terminal bud. Systematic investigation of this point might yield interesting results but entails such destruction of specimens that it is unlikely to provide a practical criterion.

Leaves. The leaves of the acaulescent species are inclined to be dimorphic, the lower shorter, with broader, fewer, and shorter leaflets. The amplitude of the leaflets is most variable, but their number to the fully developed leaf is a fairly reliable character.

Bracts. These structures are rather similar throughout the genus, differing a little in texture from herbaceous to submembranous between species and very greatly in size within the species. A bracteose condition, sometimes giving a distinctive leafy aspect to the raceme, occurs sporadically in many species of *Oxytropis,* and has formed the principal basis of several segregates in the past.

Calyx. The calyx offers a few specific characters. In two species and a variety of a third *(O. Lagopus)* it becomes inflated, enclosing the small pod; in the remainder, though often a little accrescent after anthesis, it is split by the tumescent ovary and laid back around the base of the pod. Calyx-measurements given below were taken from flowering material and sometimes do not allow for growth after the petals have fallen. The relative length of the calyx tube and teeth is pretty constant in some species but in others quite the opposite is true. The type of vesture, though not the color and very rarely the density of it, is occasionally diagnostic.

Corolla. Within reasonably narrow limits the length and amplitude of the petals are characteristic of the species, in spite of rare aberrant specimens. Their color is more constant than has often been claimed, though a few species, apart even from the polychrome hybrids, are indeed variable in this respect. The terminal cusp of the keel is quite inconstant in length and curvature, being at times reduced to a minute boss or knob, or alternatively much elongated in the same species, and then either straight or incurved.

Pod. As in the related genus *Astragalus,* the pod is here of the utmost importance in delimiting species, and yet it is deceptively variable so that a feature of it may offer a reliable criterion in one species and fail hopelessly in another. The texture of the valves is probably the most constant attribute of the legume and in doubtful cases, as in some races of *O. sericea* and *O. campestris,* may provide the sole clue to a plant's identity. The absolute and relative lengths of the body and beak, the diameter, and the degree to which the flange connecting the funicles (the false septum) is produced across the cavity are all decidedly variable. Shrinkage of the valves in drying, whether in press or by process of natural ripening, may cause a septum structurally complete (i. e. reaching from suture to suture) to appear incomplete; yet when the valves are more or less turgid, pods of the same species with septum equally developed may appear to be in varying degrees bilocular. While a strongly inflated or turgid pod is characteristic of a few species, the precise degree of inflation is not invariable; for example, in one small colony of *O. Lagopus* var. *atropurpurea* pods of nearly uniform length were found to vary from narrowly ellipsoid, through broadly oblong, to subglobose.

Hybridization

Where *O. Lambertii* with purple and *O. sericea* with white to primrose-yellow flowers meet and mingle on the higher prairies and foothills of the Atlantic slope, what appear to be hybrid swarms of uncommon vigor and complexity arise, and a stand of these plants, with scarcely two alike in color, shading from white to pink, lavender, or crimson-purple, can make a marvellously brilliant picture. These conspicuous polychrome populations have done much to obscure the distinctness of the parent species which, when in pure form, can always be separated by the attachment of the pubescence. In North Dakota, *O. campestris* var. *dispar* is similarly vari-colored, and it may well have arisen in the past from crossing between *O. Lambertii,* common in the same region, and *O. campestris* var. *gracilis* immediately to the west. In the Wyoming mountains *O. campestris* var. *gracilis* and *O. sericea* come together and resultant hybrids, intermediate in size of flower and number of leaflets and thus easy to spot in the field (though very difficult to detect in the herbarium) are not infrequent. Hybrids are to be expected wherever forms of *O. campestris* and *O. viscida* overlap in range and crosses between various strains of these two polymorphic and closely allied species are known or suspected. There are indications of an *O. campestris* var. *varians* X *O. Maydelliana* hybrid in Alaska and perhaps some other puzzles in the genus will be resolved when the scope of hybridization becomes more fully understood.

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Herbaria Consulted (with symbols, after Lanjouw, used in citation of specimens)

California Academy of Sciences, San Francisco	(CAS)
Gray Herbarium of Harvard University, Cambridge	(GH)
University of Minnesota, Minneapolis	(MINN)
Herbarium Greeneanum, Notre Dame University, South Bend	(ND)
New York Botanical Garden, New York	(NY)
Oberlin College, Oberlin, Ohio	(OB)
Philadelphia Academy of Sciences, Philadelphia	(PH)
Pomona College, Claremont	(POM)
University of Idaho, Southern Branch, Pocatello	(IDS)
Herbarium of H. D. Ripley and R. C. Barneby	(RB)[2]
Rocky Mountain Herbarium, Laramie	(WYO)
University of California, Berkeley	(UC)
United States National Museum, Washington, D. C.	(US)
University of Washington, Seattle	(WTU)
Washington State College, Pullman	(WTC)

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[2] Collections of Ripley and the writer are all represented here, and the symbol has been used only when the specimen in question has reached us from other sources.

Systematic Treatment

Key to the North American Species of Oxytropis

1. Stipules very shortly adnate to the base of the petiole; pod pendulous .... 1. *O. deflexa*

— Stipules adnate through half their length or more (or at least through 4 mm.) to the enlarged, scarious or chartaceous bases of the petioles; pod erect or speading 2

2. Leaves simple or trifoliolate, the leaflets obscurely jointed to the rachis .... 2. *O. Mertensiana*

— Leaves 5–plurifoliolate, the leaflets all jointed to the rachis 3

3. Leaflets all scattered or opposite, none germinate or fascicled at the same point on one side of the rachis 4

— Leaflets, at least on some leaves, germinate or fascicled at the same point on one side of the rachis 32

4. Racemes 1–5-flowered, subcapitate at anthesis and scarcely elongating in fruit; corolla (except in rare albino individuals) purple or violet, never ochroleucous or yellow 5

— Racemes 6–many-flowered or, if occasionally less, the petals yellow, ochroleucous or white; axis of the raceme nearly always elongating in fruit 17

5. Calyx campanulate, not turgid and but little accrescent in fruit, at length ruptured and investing the base of the pod, or thrust back and enveloping its stipe 6

— Calyx turgid at full anthesis, becoming inflated-accrescent, ultimately enclosing the body and often the beak of the pod, not ruptured. Pod small, rarely exceeding 1 cm. in length 15

6. Plants of Arctic or subarctic distribution or, if high alpine in the Rocky Mts., then the leaflets linear, glabrate in age, the flowers large (keel 10–11 mm. long), and the pod stipitate and bladdery-inflated 7

— Plants of the Rocky Mts. (Idaho to New Mexico) and westward across the Great Basin; keel (except in *O. Jonesii*, local in Utah) at most 9 mm. long; leaflets broader, densely and permanently silky-canescent or, if greenish, ovate; pod sessile or nearly so 13

7. Plants eglandular; bracts pilose dorsally; calyx-teeth (except in *O. campestris* var. *terrae-novae* of Labrador and Hudson Str.) 2–4 mm. long 8

— Plants glandular and viscid; bracts glabrous dorsally or nearly so; calyx-teeth 1.5 mm. long or less. Leaflets small, thick, corrugated when dry; cf. var. *hudsonica* of .... 14. *O. viscida*

8. Stipules thin and fragile, their margins beset with clavate processes mixed with bristly ciliae. Melville Peninsula to Alaska .... 20. *O. arctica*

— Stipules firm, the margins glabrous or with bristly ciliae only 9

9. Stipules castaneous in youth, becoming chocolate-brown in age; pod stipitate, oblong-ellipsoid. Alaska .... 6. *O. kokrinensis*

— Stipules pale green, whitish or straw-colored; pod either sessile or bladdery-inflated 10

10. Pod ellipsoid to oblong-cylindroid, not more than tumid, sessile or nearly so; plants of high latitudes 11

— Pod ovoid, ventricose-inflated, stipitate; coast of Labrador and in the Rocky Mts. from Alberta to s. Colorado .... 4. *O. podocarpa*

11. Calyx-teeth 2–4 mm. long, not less than one third as long as the tube.......... 12

— Calyx-teeth 1.5 mm. long or less, not more than one fourth as long as the tube; cf. var. *terrae-novae* of.......... 15. *O. campestris*

12. Pod 17–35 mm. long, bilocular or nearly so, the septum at least 1.5 mm. broad; petals ample, the banner 7–12 mm., the wings 4–5 mm. wide.... 5. *O. nigrescens*

— Pod about 15 mm. long, unilocular, the septum obsolete or nearly so; petals narrower, the banner less than 7 mm., the wings less than 3 mm. wide.......... 3. *O. Scammaniana*

13. Pod ovoid, ventricose-inflated, the valves membrano-chartaceous.......... 14

— Pod ellipsoid, coriaceous. N. New Mexico to Wyoming, Idaho, and s.-e. California.......... 9 *O. Parryi*

14. Flower small, the banner 6–12.5 mm. long; leaflets 7–17; Utah to n. Arizona and s. California.......... 7. *O. oreophila*

— Flower larger, the banner 14.5–17 mm. long; leaflets 3–7; Garfield and Uintah counties, Utah.......... 8. *O. Jonesii*

15. Pod chartaceous, not rigid when mature, the valves villous; septum subobsolete.......... 16

— Pod coriaceous, rigid when mature, the valves strigose. Upper N. Platte drainage, Wyoming; cf. depauperate states of.......... 17. *O. nana*

16. Bracts ovate or lance-ovate, flat above the immediate base; s.-e. Wyoming, adjacent Nebraska and Utah to Colorado.......... 10. *O. multiceps*

— Bracts narrowly lanceolate, involute; n.-w. Wyoming, Montana and Idaho; cf. depauperate states of.......... 11. *O. Lagopus*

17. Pubescence composed entirely of basifixed hairs.......... 18

— Pubescence, at least in great part, dolabriform, composed of 2-armed hairs, the descending much shorter than the ascending arm but always evident; petals usually pink-purple, rarely white or polychrome.......... 18. *O. Lambertii*

18. Stipules purplish-chestnut colored, chartaceous, the margins of the free blades beset with clavate processes mixed with bristly ciliae. High latitudes, Labrador to Alaska.......... 19. *O. Maydelliana*

— Stipules pallid, whitish, greenish or straw-colored.......... 19

19. Herbage, calyx, and pod more or less viscid-glandular, the calyx-teeth and pod often glandular-verrucose; bracts nearly always glabrous dorsally.......... 14. *O. viscida*

— Herbage, calyx, and pod eglandular; bracts pilose dorsally.......... 20

20. Flowers small, the keel 5.5–9 mm. long; pod ventricose-inflated; plants of the Great Basin to s. California.......... 7. *O. oreophila*

— Flowers larger, the keel either 1 cm. long or more, or the pod and distribution quite otherwise.......... 21

21. Calyx becoming turgid at full anthesis, strongly inflated in fruit, wholly enclosing the body and usually the beak of the small pod.......... 22

— Calyx not conspicuously accrescent in fruit, ruptured and merely investing the base of the pod.......... 23

22. Pod villous, the valves membrano-chartaceous, not rigid; corolla of medium size, the keel 11–14 mm. long; n.-w. Wyoming, Montana, e. Idaho; vars. of.......... 11 *O. Lagopus*

— Pod strigose, firmly chartaceous, rigid at maturity; corolla more ample, the keel 16–17 mm. long; N. Platte drainage and vicinity, Wyoming.... 17. *O. nana*

23. Corolla purple 24

— Corolla white, ochroleucous, or pale yellow, the keel sometimes purple-maculate 31

24. Stipules fragile, the margins beset with clavate processes mixed with bristly ciliae; arctic shores, Mackenzie westward; forms of .... 20. *O. arctica*

— Stipules firmer, not fragile, and lacking clavate processes; distribution otherwise 25

25. Calyx densely shaggy-villous or hispid-hirsute with spreading hairs; pod villous 26

— Calyx silky-pilose with appressed hairs, these sometimes mixed with a few longer villi, or shortly-pilosulous, but not densely shaggy or hispid 27

26. Vesture of the calyx densely shaggy-silky, almost or quite concealing the surface of the tube at anthesis; herbage similarly silky-villous, the scapes villous or rarely glabrate; bracts lanceolate to linear, membranous or nearly so, involute-cymbiform, shaggy-pilose dorsally; vars. of .... 11. *O. Lagopus*

— Vesture of the calyx hispid-hirsute, at anthesis not concealing the surface of the tube, and strongly contrasting with the subappressed-pilose vesture of the herbage; bracts rhombic-lanceolate, mostly herbaceous, thinly appressed-pilose, the blades plane at least in their upper two thirds; vars. of .... 12. *O. Besseyi*

27. Plants occurring in pure monochrome populations, the flowers (except for an occasional albino) of uniform purple coloring 28

— Plants occurring in mixed or polychrome populations in which individuals exhibit evident transitions between purple, pink, lilac and white or yellowish flowers 30

28. Eastern plants (Hudson Str. to Maine and Wisconsin); petals relatively narrow and short, the keel 9–13 mm. long; vars. of .... 15. *O. campestris*

— Western plants (Idaho, n. Utah and Colorado); petals larger and more ample, the keel at least 14.5 mm. long 29

29. Pod stipitate or, if subsessile, the leaflets 13 or less; scapes exserted beyond the leaves; centr. Idaho and n. Wyoming; vars. of .... 12. *O. Besseyi*

— Pod sessile; leaflets 13–25; scapes shorter than the longer leaves; n.-w. Colorado and adjacent Utah .... 13. *O. obnapiformis*

30. Robust, with large flowers, the keel usually 15 mm. long or more; leaflets 11–19, ample; pod coriaceous, rigid; cf. forms of .... 16. *O. sericea*

— More slender, smaller-flowered, the keel about 13 mm. long; leaflets 19–25, smaller; pod thinner, scarcely rigid. North Dakota; var. *dispar* of .... 15. *O. campestris*

31. Pod membrano-chartaceous, not rigid at maturity; corolla mostly small, with narrow petals, the wings not conspicuously dilated upward, about 3–4.5 mm. wide near apex (but often wider in plants of the Columbia Basin and the Coast Ranges in northern Washington); vars. of .... 15. *O. campestris*

— Pod coriaceous and rigid at maturity; corolla commonly more ample, the wings conspicuously dilated upward and at least 5 mm. wide at apex; Rocky Mts. and Great Plains (Saskatchewan to Nevada and Oklahoma), but absent from the Columbia Basin westward .... 16. *O. sericea*

32. Racemes 2–10-flowered, subumbellate at anthesis, becoming 1–2 (4) cm. long in fruit; corolla relatively large, the banner at least 18 mm., the keel at least 13 mm. long 33

— Raceme 12–35-flowered, narrowly oblong or clavate at first anthesis, becoming (3) 4–16 cm. long in fruit; corolla smaller, the banner at most 15 mm., the keel at most 11.5 mm. long........ 34

33. Leaflets 21 or more to the leaf and pseudo-verticillate throughout; region of Hudson Bay .... 21. *O. Belli*

— Leaflets 21 or less, a few only geminate in some of the leaves; an Alaskan form of .... 20. *O. arctica*

34. Herbage glandular; bracts, calyx-teeth and pod glandular-verrucose; forms of .... 14. *O. viscida*

— Herbage eglandular; verrucae absent........ 35

35. All the leaves bearing predominantly paired or whorled leaflets, solitary leaflets few or none; scapes and petioles villous-pilose with fine spreading hairs, at least at base; stipules thin and fragile; corolla purple........ 22. *O. splendens*

— Primary leaves with solitary, scattered or opposite leaflets only; scapes and peduncles ascending- or appressed-pilose; stipules firm; petals white or ochroleucous (if rarely purple cf. discussion of 14. *O. viscida);* vars. of........ 15. *O. campestris*

1. **Oxytropis deflexa** (Pall.) DC.

Caulescent, the stems with 1–7 internodes up to 5 cm. long, flexuous, ascending from a taproot and up to 2 dm. long, or permanently acaulescent and cespitose; herbage and stems loosely villous-pilose to thinly subappressed-pilose, canescent or green, the vesture often becoming tawny when dry; stipules subherbaceous, pale green or purplish, adnate through 1.5–3 (4) mm. to the petiole, the opposite margin more or less decurrent on the stem, the free blades ovate to lanceolate or drawn out into caudate-acuminate tips, 3–15 mm. long, more or less pilose dorsally, the margins ciliate or nearly naked; leaves (1.5) 5–20 cm. long; leaflets (9) 15–41, disposed in opposite or subopposite pairs horizontally to the rachis and diminishing upward along it, ovate to lance-oblong, 3–25 mm. long, loosely pilose on both faces or nearly glabrous above; peduncles erect or ascending, (2) 4–30 cm. long; racemes 5–25-flowered, either subcapitate in flower and fruit or oblong at anthesis and early becoming lax, the axis up to 15 cm. long in fruit; bracts submembranous, linear to lance-oblong, 2–7 mm. long; flowers suberect in bud, early spreading and at length pendulous and commonly secund; calyx villous-pilose, 3–6.5 mm. long; pod pendulous, subsessile, or stipitate and the stipe up to 2 mm. long, the body oblong-ellipsoid to linear-oblong in outline, 8–18 mm. long, 3–4.5 mm. in diameter, somewhat dorsiventrally compressed, sulcate ventrally, the valves thinly chartaceous, pilosulous with pale, dark, or mixed hairs, the false septum vestigial or wanting; seeds olive- or mahogany-brown 1.2–1.8 mm. in diameter.

The American representatives of the *O. deflexa* complex are among the most difficult to align in a satisfactory taxonomic pattern. The species, in the largest sense, is widely diffused in Asia eastward from Altai, with a relict station in arctic Norway, and a treatment that is not based on collections from the whole area, the only one possible at the present, cannot be anything but provincial and tentative. Since Richardson's report (1823) of *O. deflexa* in Canada, until 1928 when Fernald discussed the group, it was rather generally held that but one species, and that conspecific with the Asiatic plant, occurred in the New World. Hooker's *O. foliolosa,* which Bunge and Gray agreed in interpreting as a stemless alpine form of *O. deflexa,* was occasionally accepted as a species apart. Fernald, who maintained *O. foliolosa,* pointed out that the cordilleran plant passing as *O. deflexa* differed in floral and calycine characters from its Asiatic analogue, and separated this as *O. retrorsa* with a small-flowered variety *sericea.* And supposedly true *O. deflexa* has lately been reported from Alaska. The characters used to distinguish these three species, *O. deflexa, O. retrorsa,* and *O. foliolosa* are few and, as I shall attempt to show, scarcely of specific value. In the following paragraphs it should be understood that the epithet "*deflexa*" is used in the narrowest, Asiatic sense.

Caulescence. Stemlessness is said to characteristic of *O. foliolosa,* developed internodes of *O. deflexa,* whereas *O. retrorsa,* normally caulescent, varies into an "acaulescent or subacaulescent," "more northern or more alpine" (Fernald, 1928, p. 140) var. *sericea.* In point of fact *O. foliolosa,* although always acaulescent in Labrador and usually so in the Rockies, may occasionally, when carried down along streams from alpine elevations, produce one or two short but evident internodes. A stemless variety of *O. deflexa* (var. *subcapitata* Trautv., Act. Hort. Petrop., 5: 38, 1877) has been described from northern Siberia. It is possible of course that this, of which I have seen no material, is actually *O. foliolosa* itself, but in any case it will be seen that the state of caulescence is not to be applied as a rigid criterion.

Length of fruiting raceme. The raceme of *O. foliolosa* is said scarcely to elongate, whereas it becomes lax and open in *O. retrorsa* and *O. deflexa.* But the length of the raceme is closely correlated with the degree of caulescence, in some robust cordilleran specimens of *O. foliolosa* attaining a length of 2.5 cm., while in some condensed examples of *O. retrorsa* it may remain less than 5 mm. long. The *O. deflexa* var. *subcapitata* was described as having the fruiting raceme subcapitate. The length of the raceme is therefore not wholly reliable.

Calyx. A broadly campanulate calyx with truncate tube and narrow teeth separated by broad, obtuse sinuses is actually characteristic of *O. deflexa* and *O. foliolosa.* In *O. retrorsa* the calyx is proportionately narrower, with lanceolate, approximate teeth separated (except on the axial side) by narrow and acute sinuses. In the latter, however, the calyx is extraordinarily variable in length and, while at their maxima the shape and disposition of the teeth are distinctive, this state is linked by a series of intermediates with a small extreme in which the tube becomes shortly campanulate, and the ventral and lateral sinuses scarcely if at all narrower than in the smallest-flowered Asiatic state of *O. deflexa*. It is difficult to draw a clear line between the Old and New World species on this basis.

Petals. The banner of *O. deflexa* and *O. foliolosa* is in each case relatively broad and the whole flower of a good purple, while that of *O. retrorsa* is narrower in proportion to its length and usually pale. Very small-flowered examples of *O. deflexa* and corresponding specimens of *O. retrorsa* are nearly identical, however, in shape of the petals, while the flower of *O. retrorsa* is occasionally highly colored.

Pod. The pod is identical in structure in all three species but that of *O. foliolosa* is supposedly shorter, according to current accounts. The pod of *O. retrorsa* has been found to vary between 10 and 18 mm. in length, that of *O. foliolosa* between 8 and 17 mm. The stipe tends to be longer in *O. foliolosa* but is not absolutely so.

Distribution. While the dispersal of a species cannot be said to be a "taxonomic character," it is often, in practice, a distinctive quality, one which may furnish invaluable evidence of the nature and history of a taxon. I cannot speak with authority of the extra-American distribution of *O. deflexa*, but in its sporadic American occurrence it appears to exist only in a few relict stations in alpine Colorado and the Yukon valley, thus having all the appearances of a species which was nearly exterminated by the Tertiary glaciations and so depauperated by them that its power to reoccupy old territory was practically exhausted. *Oxytropis foliolosa*, again alpine in the Rocky Mountains, but with scattered stations in Labrador, Gaspé, and the coast of Mackenzie, exhibits in its main area a certain variability and power to adapt itself to various sites and elevations, but is very likely an ancient immigrant from Asia, and probably poor in biotypes at the present time. By contrast *O. retrorsa*, with a nearly continuous range at middle altitudes from New Mexico to Alaska, is extremely variable, plastic in relationship to environment, and aggressively expanding. It occurs in quantity in the Rocky Mountains where it is quick to occupy newly available territory such as roadside ditches or grazed meadowland, and is rich in small variations of a type often characteristic of new (or at least not senescent) species.

Conclusions. Oxytropis deflexa differs, then, from *O. foliolosa* in that it is *usually* caulescent and more densely hairy, and in the *usually* longer racemes. The two species are precisely alike in flower and legume and can scarcely be held specifically distinct. *Oxytropis retrorsa*, which embraces a range of variation in caulescence, length of raceme, and density of vesture parallel with that found in *O. deflexa* and *O. foliolosa* combined, differs appreciably from either only in the form of the calyx and corolla. But as we have seen, the smallest-flowered forms of *O. retrorsa* and *O. deflexa* are so nearly alike even in these organs that it is possible to trace a complete sequence of variation between the extremes. *Oxytropis retrorsa* is here interpreted as the variable, aggressive, post-glacial progeny of an old, widely dispersed species which persists unchanged as a relict in a few favored stations in America. It seems not yet sufficiently modified to have acquired a true separation from the ancestral type, and is here subordinated, as var. *sericea,* to *O. deflexa.*

KEY TO THE AMERICAN VARIETIES OF O. DEFLEXA

1. Lateral sinuses of the calyx similar to the ventral, broad and obtuse; petals ample, purple, the banner broadly obcordate, about twice longer than broad 2

— Lateral sinuses similar to the dorsal pair, narrow and acute, rarely a little broader and rounded; petals narrower, commonly only bluish- or purplish-tinged, the banner oblanceolate, about three times longer than broad........................c. var. *sericea*

2. Copiously and loosely villous-pilose; stems commonly developed, with at least one apparent internode at maturity; raceme (5) 10–20-flowered, usually elongating in fruit; alpine in Colorado; Yukon valley; Asia..........a. var. *deflexa*

— Sparingly pilose, green, the vesture usually appressed; stems usually none, but occasionally with one or two developed internodes; raceme (2) 7–10-flowered, nearly always compact in fruit........................b. var. *foliolosa*

1a. **Oxytropis deflexa** (Pall.) DC. var. **deflexa**

Oxytropis deflexa (Pall.) DC., Astrag., 33, tab. 27. 1802. *Astragalus deflexus* Pall., Act. Acad. Petrop., 2: 268, tab. XV. 1779. *Aragallus deflexus* (Pall.) A. Hell., Cat. N. Amer. Pl., 4. 1898.

Astragalus retroflexus Pall., Astrag., 33, tab. 27. 1800.

Caulescent or subacaulescent; permanently silky-pilose, the stems and petioles more or less villous with spreading or retrorse hairs; leaves 5–15 cm. long, with 25–35 leaflets; racemes 5–20-flowered, 1.5–6 (and probably more) cm. long in fruit; calyx 3–6.5 mm. long, densely pilose with some or nearly all fuscous hairs, the campanulate tube 2–3.5 mm., the teeth (usually narrowly linear) 1–3 mm. long, the ventral sinuses broad and obtuse; corolla purple, the obcordate banner 4–10.5 mm. long, 2.2–5 mm. broad; wings 4.5–9 mm. long, the blades 1–2.5 mm. broad, obtuse or obliquely truncate; keel 4–8.5 mm. long, the appendage minute or up to 1 mm. long. *Type* collected by Simon Peter Pallas, ". . . ad nivalia juga Dauriae . . . in excelsis montibus circa Balyra rivum aliosque Ononem influentibus."

Distribution: Alpine in central and southwestern Colorado; upper Yukon Valley; Siberia westward to Altai; reported from Norway (Finmark: subsp. *norwegica* Nordh.). Map 1.

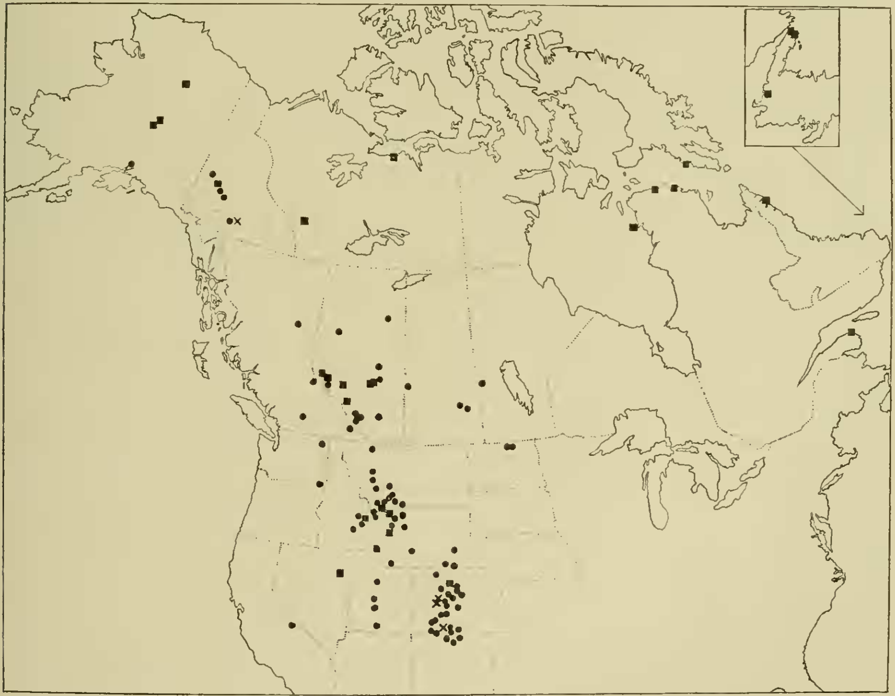
American specimens studied: YUKON. Lower Laberge, *J. P. Anderson 1774* (POM). COLORADO. Sheep Mount, *Purpus 703* (UC). East River, Gunnison County, *Coulter, Hayden's Survey in 1873* (US). Virginia Peak, n.-e. of Gothic, Gunnison County, *B. Osborn 2446* (US). Rio Grande National Forest, Mineral County, *Murdoch 4607* (CAS, NY). Sawatch Range, Pitkin (or Lake) County, *Brandegee in 1880* (NY, UC).

The Colorado plant seems to match genuine Asiatic material of *O. deflexa* at every point. A similar case of interrupted distribution is known in *Draba fladnizensis* Wulf., native (acc. C. L. Hitchc., Univ. Wash. Pub. Biol., 11: 108, 1941) to Colorado, one mountain in British Columbia, and Norway, and subsequently discovered in the Sierra Nevada, California, by Mr. Howell; so that the occurrence of var. *deflexa* in America is not without precedent. The Murdoch gathering was found in a cover (NY) labelled by Rydberg with an unpublished name. Rydberg had realized that the specimen was not exactly *O. deflexa* as then accepted.

1b. **Oxytropis deflexa** (Pall.) DC. var. **foliolosa** (Hook.) Barneby

Oxytropis deflexa (Pall.) DC. var. *foliolosa* (Hook.), Barneby, Leafl. West. Bot. 5:111. 1951. *O. foliolosa* Hook., Fl. Bor.-Amer., 1:46. 1834. *Aragallus foliolosus* "Hook." ex Macoun, Ottawa Nat., 13:163. 1899. *Astragalus deflexus* var. *foliolosus* (Hook.) Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937.

Acaulescent or sometimes with one (or even two) developed internodes; vesture commonly sparse, subappressed, or with some spreading hairs on



Map 1. Range of *Oxytropis deflexa:* var. *deflexa* (in America) **X**; var. *foliolosa* (Newfoundland inset) ■; var. *sericea* ●.

petioles and peduncles, rarely canescent when young; leaves 1.5–12 (22) cm. long, with (9) 15–29 leaflets; racemes (2) 4–10-flowered, subcapitate in early anthesis, rarely elongating in fruit, the axis 3–30 (rarely to 80!) mm. long; calyx 6–7 mm. long, the campanulate tube 3–4. mm., the teeth 2.5–3 mm. long, the ventral and lateral sinuses broad and obtuse; corolla purple, the banner 7–10 mm. long, (3.5) 4.5–5.5 mm. broad; wings (7) 7.5–8.5 mm. long, the blades 1.5–2 mm. broad; keel 7–8.5 mm. long, the appendage 0.5 mm. long or reduced to a minute boss; stipe of the pod 1.5–2 mm. long, the body 8–17 mm. long, 3–4.5 mm. in diameter. *Type* from "Carlton House to the Rocky Mountains, in latitude 54°" (i. e. Alberta), the collector not stated.

Distribution: Alpine crests and meadows in the Rocky Mountains, from Colorado to Alaska, rarely descending along streams to the north; also on arctic and subarctic shores of Mackenzie, Ungava Peninsula, Baffin Island, Labrador, w. Newfoundland, and on Gaspé Peninsula, Quebec. Map 1.

Representative specimens: Alaska. Wiseman, *Scamman 944* (GH). Savage River near Savage Camp, *Mexia 2031* (CAS, US). Franklin. Lake Harbor, Baffin I., *Polunin 1399* (US). Alberta. "Rocky Mts.," *Burke* (GH, ex herb. Hook.). Fort Saskatchewan, *G. H. Turner 1342, 2465* (GH, the caulescent extreme). Quebec. Smith I., e. coast Hudson Bay, *Malte 120885* (GH). Anse Pleureuse, Gaspé County, *Marie-Victorin & Rolland-Germain 49426* (GH, WTC). Labrador. Rowsell Harbor, *Abbe & Odell 460* (GH). Newfoundland. Cook Point, Pistolet Bay, *Fernald & Gilbert 28601* (GH). Montana. Koch Peak, Taylor Mts., Madison County, *Hitchcock & Muhlick 15188* (NY, RB, WTC, WTU). Idaho. East fork Pahsimeroi River, Custer County, *Hitchcock & Muhlick 11096* (CAS, NY, WCT, WTU). Wyoming. Teton Pass Mts. e. of Victor, *E. & L. Payson 2130* (CAS, GH, NY). Nevada. Liberty Pass, Ruby Mts., Elko County, *Munz 16225* (POM). Colorado. Willis Gulch, Gilpin County, *Biltmore Herb. 1646* (US).

While material from the Northeast is rather uniform in detail and appearance, var. *foliolosa* is evidently more variable in the Rocky Mountains. Robust, loosely flowered examples from the lowlands in Alberta and diminutive plants from Yellowstone Park (e. g. *Tweedy 78*, NY) exhibit opposite extremes in stature, length of fruiting raceme, and length of pod. Occasionally, as in Miss Scamman's Alaskan plant, one developed internode is produced, when the variety can scarcely be distinguished from var. *deflexa* (to which the specimen was referred in Rhodora, 42: 333) except by the fewer-flowered raceme and usually fewer leaflets.

It seems quite possible that *O. deflexa* var. *subcapitata* Trautv., described from plants collected in northern Siberia by Czekanowski and Mueller, may be an earlier varietal name for var. *foliolosa.* The diagnosis calls for a stemless plant with subcapitate fruiting raceme. No material of var. *foliolosa* has been seen from beyond Behring Strait, but it might well extend into

Asia. The point can be decided only by reference to the type, presumably in Leningrad.

Oxytropis foliolosa has often been likened to the Eurasian *O. lapponica* (Wahlenb.) J. Gay, the inflorescence of which is quite similar. But the stipules of *O. lapponica,* connate into a sheath opposite the petiole, are fundamentally different.

1c. **Oxytropis deflexa** (Pall.) DC. var. **sericea** T. & G.

Oxytropis deflexa (Pall.) DC. *β sericea* T. & G., Fl. N. Amer., 1:342. 1838, *sensu ampliato. O. retrorsa* Fern. var. *sericea* (T. & G.) Fern., Rhodora, 30:140. 1928.

O. retrorsa Fern., 1928, l. c.

O. deflexa var. *culminis* Jeps., Fl. Calif., 2:381. 1936.

O. deflexa sensu auct. amer. plur. (saepe sub *Aragallo);* non DC.

Usually caulescent, rarely stemless; herbage and stems loosely villous-pilose, the hairs on the stems and petioles often horizontally spreading or retrorse, the whole greenish or somewhat canescent; leaves 5–20 cm. long, with 23–41 leaflets; racemes usually 10–25-flowered, when oblong-pyramidal in bud and early becoming lax, the fruiting axis 5–13 cm. long, but rarely only 3–10-flowered, when short or even subcapitate in fruit; calyx at anthesis 4–8 mm. long, sometimes a trifle accrescent in fruit, the campanulate to narrowly turbinate tube 2–3.5 mm., the lanceolate teeth (1.5) 2–4 (5) mm. long, separated, except on the ventral side, by narrow and acute sinuses; corolla commonly pale, whitish, lilac or bluish, sometimes tipped with deep purple, the banner 4.5–9 mm. long, 2.3–3.5 mm. broad; wings 5–8 mm. long, the blades about 1 mm. broad; keel 4.3–8 mm. long, the appendage usually minute. *Type* collected by Thomas Nuttall, in 1834, in the "Rocky Mountains, near streams" (i. e. probably western Wyoming) ; "Ore. Ry. Mts.," *Nuttall* (NY) !

Distribution: Stream-banks, meadowland, mountain parks, often along ditches or grassy swales, rarely in dry soils, at middle and rather high altitudes in the Rocky Mountains from Alaska to northern New Mexico, westward to eastern Washington, Oregon and California, and eastward on the northern plains to Manitoba. Map 1.

Representative specimens: ALASKA. Matanuska, *J. P. Anderson 900* (US). YUKON. Carmacks, *Eastwood 573* (CAS, GH, POM, US, WTC). BRITISH COLUMBIA. Chipuin Mt., Marble Mts., *J. W. & E. Thompson 544* (US, WTU). ALBERTA. Rosebud Creek, Rosedale, *Moodie 1200* (GH, NY, US). SASKATCHEWAN. Ribstone Creek, *Macoun & Herriott 70801* (CAS, NY, POM). MANITOBA. Red Deer Lakes, *J. Macoun 454* (NY). WASHINGTON. Wauconda Summit, Okanogan County, *J. W. Thompson 7119* (GH, WTU). IDAHO. Challis, Custer County, *Macbride & Payson 3346* (CAS, POM, US). MONTANA. Warmsprings, Deer Lodge County, *Ripley & Barneby 8158*

(CAS). Boulder Canyon, Sweet Grass County, *C. L. Hitchcock 16342* (RB, WTC, WTU). Oregon. Hurricane Creek, Wallowa County, *Peck 22597* (RB). Wyoming. Leckie, Sweetwater County, *Merrill & Wilcox 774* (GH, NY). California. Cottonwood Creek, White Mts., Mono County, *Duran 1650* (UC, type of *O. deflexa* var. *culminis). Utah. Aquarius Plateau, Garfield County, *Maguire 19175* (GH, IDS, WTU). Colorado. Como, Park County, *Crandall & Cowen 152* (GH, type of *O. retrorsa), Crandall 116* (US). Arboles, Archuleta County, *C. F. Baker 410* (GH, NY, POM, US). New Mexico. Chama, Rio Arriba County, *Earle 30* (NY).

The var. *sericea* is here extended to embrace the whole of Fernald's *O. retrorsa.* It is regrettable that the epithet "*retrorsa,*" originally intended to cover nearly the same concept, cannot be conserved, but var. *sericea* has obvious priority if included in it. The original *O. deflexa β sericea* was separated upon the superficial single character of "leaves silky-villous," and the basic Nuttall specimen in the Torrey Herbarium is a young, densely pilose plant, as yet without developed internodes, with short, *dark*-hairy calyx (5.5 mm. long), its teeth separated by the acute sinuses characteristic of the common cordilleran plant, and with small, pale, narrow-petalled flower. Fernald maintained this as a variety of caulescent, larger-flowered and greener *O. retrorsa* on account of its "smaller leaves, pale (!) calyx only 3.5–5.5 mm. long, and paler corolla . . ." To test these characters 63 sheets, equably covering the range of *O. retrorsa* (NY, RB) were separated on the basis of calyx-measurements, 26 having the calyx 4–5.5 mm., and 37 the calyx 6–8 mm. long. In the first group only six were found to be acaulescent or subacaulescent (with not more than one developed internode), while there were three in the other. The calyx-hairs of the first group were in nine cases predominantly pale, in four predominantly fuscous, and in thirteen mixed in about equal proportions; in the large-calyxed group two-thirds (23) were dark-haired, eight pale, and six intermediate. Sericeous and glabrate herbage occurred in both series. Fernald, to be sure, admitted the existence of numerous intermediates, but the factors are too little correlated to be used with profit in defining a variety. At Silverton, Colorado, it was noticed that plants growing along a swale *(Ripley & Barneby 7109,* CAS) were strongly caulescent, dark-hairy on the long calyx and relatively large-flowered (with purplish banner about 9 mm. long), whereas on the drier banks nearby occurred a subacaulescent phase, with pale, shorter calyx and smaller corolla (the banner whitish and about 6 mm. long). Here the available moisture seemed to be the controlling factor.

The variety is strikingly variable in size of corolla, in length of calyx-teeth, and in development of the raceme, and it is a temptation to separate the extreme forms. Particularly remarkable are the following:

a. Plants from Alberta, British Columbia and Yukon (Banff, *McCalla 2125*, NY, US, WTU) with minute corolla, shortly campanulate calyx with rather broad lateral sinuses between the teeth, and short pod, 10–12 mm. long. These closely approach the smallest-flowered forms of var. *deflexa* from Asia, differing in the pale corolla and narrower banner. Probably this is the equivalent of the "Eastern Siberian-Alaskan type" which Hultén (Fl. Alaska & Yukon 1096) defines so as to include the relict Norwegian race of the species, material of which I have not seen.

b. Plants from Idaho and Montana (Hyndman Creek, Blaine County, *J. W. Thompson 13516,* WTU, RB; Wilsall, Park County, *Suksdorf 609,* CAS), caulescent or acaulescent but in either case slender throughout, glabrate, with filiform peduncles and 4–9-flowered racemes lax in fruit, and rather few leaflets. In the Thompson collection an occasional secondary raceme is very shortly pedunculate, with fruiting axis only 6 mm. long. In Dr. Peck's most curious gathering from the Wallowa Mts., Oregon (cited above), the racemes are all reduced to three or four flowers and remain abbreviated in fruit, the plant thereby closely simulating var. *foliolosa* in habit. But the narrow pale flowers are those of var. *sericea.*

2. **Oxytropis Mertensiana** Turcz.

Oxytropis Mertensiana Turcz., Bull. Soc. Nat. Mosc., 1840, p. 68. 1840. *Spiesia Mertensiana* (Turcz.) O. Kze., Rev. Gen., 206. 1891. *Aragallus Mertensianus* (Turcz.) Greene, Pittonia, 3:211. 1897.

Acaulescent, but the slender caudex-branches elongating and up to 11 cm. long, clothed in imbricated stipules; stipules membranous, pale, connate at base, 10–15 mm. long, glabrous dorsally, the deltoid to lance-subulate free blades 1.5–9 mm. long, sparingly bristly-ciliate; leaves (1) 2–7 cm. long, the primary 1-foliolate, reduced to a single terminal ovate, lanceolate or elliptic acute blade 8–22 (29) mm. long, 2–5 mm. broad, obscurely if at all articulate to the glabrous petiole, the secondary simple to subpalmately 3-foliolate, the leaflets all 3-nerved, glabrous below, sparingly pilose above or merely ciliate along the inrolled margins; scapes erect or ascending, 2.5–6 cm. long, equalling or surpassing the leaves, thinly villous-pilose, the hairs becoming black toward the inflorescence; racemes loosely 2–3 (4) -flowered, the flowers ascending, the axis not more than 5 mm. long in fruit; bracts linear, membranous, 3–6 mm. long, black-hirsute dorsally; calyx 5.5–8 mm. long, densely black villous-hirsute, the tube 4–5 mm., the linear-subulate teeth 1.5–3 mm. long; petals purple, the claws paler than the blades; banner obovate, emarginate, 12–14.5 mm. long; wings 9.5–11 mm. long; keel 8–10 mm. long, the claws and blade subequal, the appendage minute; pod stipitate, the stipe 1.5–2 mm. long, the body ovoid-oblong or lance-oblong, 11–15 mm. long, 4–5 mm. in diameter, passing into a short, more or less divergent beak, the valves membrano-chartaceous, pilose-hirsutulous with black hairs, the false septum rudimentary, about 0.5 mm. broad. *Type* collected by Dr. Mertens, "ad sinum Sancti Laurentii."

Distribution: Rocky ground, apparently often among moss and lichens, interior Alaska to Seward Peninsula, Cape Lisburne (fide Gray), islands of Behring Strait, and westward to the Lena River (Yakutsk Prov., Siberia). Map 2.

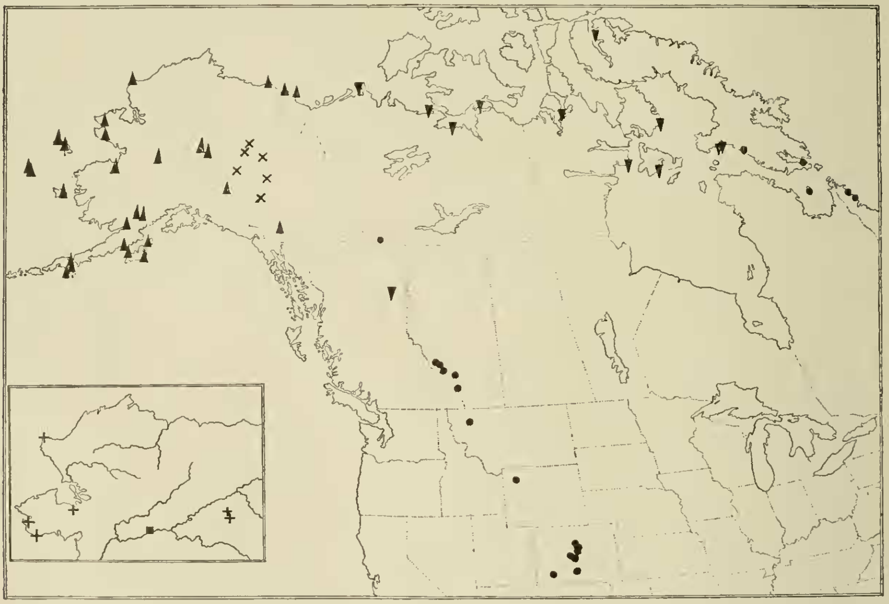
Representative American specimens: ALASKA. Porcupine Dome, *Scamman 809* (GH). Upper Kougarok River, Seward Peninsula, *Atwater in 1909* (GH). Cape Nome, *Blaisdell in 1900* (GH, NY, US).

The slender habit, simple primary and trifoliolate secondary leaves, all glabrous on the lower surface, and the few-flowered, densely black-villous inflorescence readily identify this curious little species.

3. **Oxytropis Scammaniana** Hultén

Oxytropis Scammaniana Hultén, Ark. Bot., 33B:4, fig. 2, 3 (map), 1947.

Densely or more often loosely cespitose, the caudex-branches either arrested or elongating and up to 8 cm. long; herbage green, the leaflets sparingly pilose, the inflorescence copiously hirsute with black hairs; stipules pale or faintly purple-tinged, 7–13 mm. long, glabrous or nearly so dorsally, the free blades ovate to lanceolate, 1.5–6 mm. long, prominently 1-nerved, at first ciliate with white or some fuscous bristles, the cilia at length deciduous; leaves 2–6 cm. long, the slender petioles subglabrous or



Maps 2 (northwestern Alaska and middle Yukon valley, inset) and 3. Ranges of *Oxytropis Mertensiana* (in America) +; *O. kokrinensis* ■; *O. podocarpa* ●; *O. Scammaniana* X; and *O. nigrescens:* var. *nigrescens* (in America) ▲; and var. *uniflora* ▼.

with a few scattered hairs; leaflets 9–13 (19), narrowly ovate to linear-lanceolate, 2.5–9 mm. long, thinly pilose or glabrate above, ciliate; scapes 2.5–6 cm. long, erect or ascending, sparingly appressed-pilose, the hairs below the inflorescence commonly fuscous; bracts lanceolate, membranous, 2–4 mm. long, loosely black-pilose dorsally; racemes subcapitately 3–4-flowered, the axis short in fruit; calyx 5.5–7 mm. long, shaggy-pilose with dark hairs (but the vesture scarcely concealing the purplish tube), the tube 3–4.5 mm., the teeth 1.5–2.5 mm. long; corolla purple, drying violet, the claws paler than the petal-blades; banner 11–14 mm. long, broadly oblanceolate, 5.5–6.5 mm. wide below the deeply emarginate apex; wings (9) 10–11.5 mm. long, the lunate blades 7–8 mm long, 2–2.5 mm. wide near the truncate or merely oblique apex; keel 8.5–10 mm. long, the appendage commonly minute; pod sessile, oblong-ellipsoid, about 15 mm. long and 5 mm. in diameter, obtuse at base and passing abruptly upward into a short deltoid beak, sulcate ventrally, the membranous valves pilosulous with black hairs, the septum from the ventral suture very narrow or obsolete; seeds brown, 1.2–1.8 mm. long. *Type* collected by Edith Scamman, at Eagle Summit, Alaska; *Scamman 806* (GH, isotype)!

Distribution: Stony hillsides in the mountains of east-central Alaska and adjacent Yukon. Map 3.

Representative specimens: Alaska. Eagle Summit, *Scamman 2212* (GH, US). Seward Creek near Eagle, *Osgood in 1903* (US). Porcupine Dome, *Scamman 807* (GH). Yukon. White River, 61° 50′ N., *Cairnes 85865* (NY). Near Glacier, *Margaret Milvain in 1914* (CAS).

Although at first confused with *O. arctica* (Rhodora, 42:332, 1940), very different in its fragile stipules and dense silky vesture, *O. Scammaniana* belongs to quite another group of species, and when in flower only most closely resembles the more glabrous states of *O. nigrescens,* differing however in the narrower petals. As the fruit matures, the short and essentially unilocular pod is characteristic. The inflorescence and pod are similar to those of *O. Mertensiana,* which is probably its nearest American relative.

A specimen from "Juneau" *(ex herb. Kofoid.,* OB) is perhaps wrongly labelled as to locality. Until the record can be confirmed this station must be looked on with suspicion, in view of the known distribution of the species. It is omitted from the map.

4. **Oxytropis podocarpa** Gray

Oxytropis podocarpa Gray, Proc. Amer. Acad., 6:234. 1864. *Spiesia podocarpa* (Gray) O. Kze., Rev. Gen., 206. 1891. *Aragallus podocarpus* (Gray) A. Nels., Coult. & Nels., New Man., 294. 1909. *Astragalus septentrionalis* Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937.

O. arctica δ inflata Hook., Fl. Bor.-Amer., 1:146. 1834. *Spiesia inflata* (Hook.) Britt., Mem. Torr. Club, 5:201. 1894. *Aragallus inflatus* (Hook.) A. Nels., Erythea, 7:59. 1899. *Oxytropis inflata* (Hook.) Steffen, Beih. Bot. Centralbl., 58B:162. 1938, nomen (without citation).

Astragalus biflorus Schwein. ex Gray, Proc. Amer. Acad., 6:234. 1864, in syn.
Oxytropis Hallii Bge., Gen. Oxytr. 162. 1874. *Aragallus Hallii* (Bge.) Rydb., Bull. Torr. Club 33:144. 1906.

Densely cespitose, or the slender divisions of the caudex sometimes elongating and up to 3 cm. long, beset with a thatch of persistent stipules or leaf-bases; herbage pilose-hispidulous with loosely appressed or at first divergent hairs, in youth or sometimes permanently canescent, but commonly becoming greenish at maturity; stipules 6–10 mm. long, sparingly hirsute dorsally to glabrate, the ovate-deltoid to lanceolate free blades 1.5–6 mm. long, bristly-ciliate along the margins, or only at apex, or the cilia at length deciduous; leaves ascending and spreading, 0.5–4 (6) cm. long, the slender petioles densely to sparsely pilose-hirsutulous, rarely glabrate; leaflets (5) 9–13, crowded on a rachis 1–7 (10) mm. long, linear-lanceolate or linear, commonly involute and falcate, the surfaces usually sparingly hirsute and greenish, the margins more copiously so; scapes divergent, or erect at early anthesis, 0.5–4 (5) cm. long, sparingly pilose; racemes subcapitately 1–3-flowered, the flowers spreading on slender pedicels 1.5–2 mm. long; bracts ovate to lanceolate, acute or short-acuminate, hispidulous to subglabrous dorsally, ciliate; calyx 7–10 mm. long, thinly shaggy-pilose, commonly with a mixture of short dark and longer pale hairs (but either sort predominating or almost lacking), the vesture rarely concealing the surface of the tube, the latter campanulate, often narrowed into an obconic base, 5–7 mm. long, the obtusish, deltoid-lanceolate teeth (1) 2–2.5 (3) mm. long; corolla purple; banner 13–15 (17) mm. long, abruptly expanded above the claw into a suborbicular-obcordate blade 7–8 mm. wide; wings 11–13 mm. long, the blades 7–8 mm. long, somewhat dilated upward and about 3.5 mm. wide near apex; keel 10–11 mm. long, the blades about 5 mm. long, the appendage reduced to a minute boss; pod stipitate, the stipe 1.5–3 mm. long, the body ovoid-ellipsoid, bladdery-inflated, 1.5–2.5 (3) cm. long, 5–8 (when pressed, to 15) mm. in diameter, somewhat obcompressed, abruptly narrowed above into a conic-acuminate beak 3–6 (8) mm. long, the valves thinly chartaceous, strigose-pilosulous with short light or dark hairs, the false septum 1 mm. wide or less; seeds mahogany-brown, 2.2–2.5 mm. in diameter. *Type,* as originally stated, from "Labrador, Arctic regions and Rocky Mountains, lat. 49°," but by elimination of extraneous elements, Labrador and Alberta, collected by Schweinitz and Bourgeau, respectively: "*Astragalus biflorus* ex herb. Schweinitz." (GH); Rocky Mts., *Bourgeau* (GH)!

Distribution: Exposed rocky ridges and turfy hillsides above timberline in the Rocky Mountains, from Colorado to Alberta, and perhaps northward into southwestern Mackenzie; also on the coasts of Labrador, Hudson Strait, and Baffin Island. Map 3.

Representative specimens: Without locality, "*O. arctica* comm. Hooker" (GH, NY, presumed authentic *O. arctica* var. *inflata).* Franklin. Frobisher

Bay, Baffin I., *Sewall 260* (GH). Labrador. Hebron to Nachvak, *Delabarre 49* (GH). Alberta. Pipestone Pass, *Macoun 65067* (GH, NY, US). Montana. Yellow Mt., Teton County, *R. S. Williams 1086* (NY). Wyoming. Yount's Peak, Park County, *Tweedy 261a* (NY). Colorado. Rocky Mts., lat. 39°–41°, *Hall & Harbour in 1862* (GH, NY, US, isotypes of *O. Hallii*[3]). Mosquito Pass, e. of Leadville, Lake County, *Ripley & Barneby 10030* (CAS, GH, WYO). Handies Peak, Hinsdale County, *Penland 1531* (CAS).

Oxytropis podocarpa, although unmistakable when bearing its bladdery, stipitate pod, is closely related to typical *O. nigrescens,* and before the fruit has formed the two species are not easy to distinguish. The vesture of both may be copiously hirsute (as in the type of *O. Hallii* and in most material of var. *nigrescens* from Behring Strait), but in nearly all cases it becomes thinner and more appressed in age, and may be so from the first. Both species occur in relatively condensed and giant phases, the large and small extremes in the present species—*O. Hallii* and *O. podocarpa* sensu stricto as defined by Fernald, Rhodora, 30: 155—being duplicated in typical *O. nigrescens* and its dwarf state known as *O. pygmaea.* The stipules tend to be longer, with narrower and more drawn-out free blades, in the loose or large aspect of each species; but there is much variation in the development of these structures and both types of stipule can be found in the same collection. Fernald claimed that *O. Hallii,* in addition to a coarser habit and longer stipule-blades, differed from *O. podocarpa* in its "more numerous and coarser leaflets, and capsules firmer, less stipitate and larger" (l. c.). Much of the most condensed material from the Alberta Rockies referable in these terms to *O. podocarpa* agrees with the type of *O. Hallii* in having 13 leaflets 5 mm. long or less. No correlation exists either between size and texture of the pod, or between size of pod and length of stipe, but rather a complete sequence of variation, such as is characteristic of many a species of *Oxytropis, O. Hallii* in this case representing the more robust end. Rydberg's attempt to maintain *O. Hallii* as distinct on the basis of "densely canescent" leaflets (Fl. Rocky Mts., in the key) is entirely at variance with a natural classification.

The difficulty in separating *O. nigrescens* and *O. podocarpa,* referred to above, exists in practice only in Alaska, where both species have been thought to occur. In 1884 Gray doubtfully referred to *O. podocarpa* some flowering plants from the Shumagin and Chiachi islands *(Harrington in 1872, Dall in 1874,* respectively, GH), and these were accepted without question by Fernald; but until undoubted fruits of *O. podocarpa* can be secured from this area there is no reason to suppose that the specimens cited, and others like them from Kodiak, are not forms of *O. nigrescens* var. *nigrescens.* In fact Hultén (Fl. Aleut. Is., 234; Fl. Alaska & Yukon,

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[3] Bunge gave the type locality of *O. Hallii* as "Athens, Illinois," copied from the postal address which appears on some Hall and Harbour labels.

1104) has firmly rejected *O. podocarpa* from the extreme Northwest, though it is questionable whether the differences in pubescence of the stipules emphasized by him are reliable criteria.

Commenting on Gray's publication of *O. podocarpa,* Fernald pointed out that the Arctic distribution, as originally stated, is probably erroneous although he had not seen the specimens on which Gray's statement was based. Certainly the "*O. campestris,* Parry" in the Torrey Herbarium, mentioned by Gray, is *O. nigrescens* var. *uniflora.* The "*O. arctica* of Richardson" (NY), in young flower, looks like an unusually silky example of *O. podocarpa* but neither its origin nor its identity is certain. In any case these doubtful records were omitted from Gray's second revision (1884, after he had seen the Kew collections), and *O. podocarpa* can be excluded with some confidence from "Arctic America."

In the same paper Fernald chose the little plant from Labrador, *Astragalus biflorus* of Schweinitz, listed first by Gray, as the type of *O. podocarpa,* and transferred the Bourgeau gathering to *O. Hallii.* Bourgeau's plant was, however, the only fruiting specimen (except perhaps the type of *O. arctica* var. *inflata* Hook., which Gray did not claim to have seen) available at the time, and almost certainly furnished the basic evidence on which Gray defined *O. podocarpa* as a species distinct from *O. arctica.* To those who can see in *O. Hallii* nothing more than a luxuriant phase of *O. podocarpa* the question of typification will be academic; but it seems unjust in any case to divorce Gray's binomial from the species to which Bourgeau's plant belongs, since this is the specimen from which the critical characters, not to mention the epithet of *O. podocarpa* were so largely drawn. The Bourgeau and Schweinitz plants are here taken as cotypical and admirably illustrative of their species.

5. **Oxytropis nigrescens** (Pall.) Fisch.

Loosely matted, cespitose, or pulvinate, the caudex-branches clothed in imbricated stipules and leaf-bases, either very short, or developed and up to 8 cm. long; vesture of the herbage sparsely and loosely pilose to densely silky-villous, the hairs shining and commonly sinuous; stipules firmly membranous at maturity, pale 5–15 mm. long, more or less pilose dorsally when young, commonly glabrate or even glabrous in age, the free blades deltoid-ovate to long-acuminate, prominently 1-nerved; leaves 0.5–4 (6) cm. long; leaflets 5–15, ovate to linear-elliptic, acute or obtuse, less than 1 cm. long, commonly crowded; scapes almost none to 4 cm. long, erect and ascending; racemes subumbellately 1–4 (usually 1 or 2) -flowered, the flowers spreading; calyx shaggy-hirsute, usually with black hairs, the broadly campanulate tube 3–6 mm., the lanceolate teeth 2–4 mm. long; corolla bright purple, drying violet, exceptionally white; banner 14–20 mm.

long, the blade suborbicular-obcordate, 7–12 mm. wide; wings 11–16 mm. long, the blades somewhat dilated upward and 4–5 mm. wide near the emarginate apex; keel 10–13 mm. long, the appendage less than 1 mm. long; pod spreading, subsessile, the stipe, when perceptible, not more than 0.5 mm. long, the body narrowly oblong-ellipsoid, acuminate or abruptly narrowed at both ends, 1.7–3.8 cm. long, 4–8 mm. in diameter, nearly terete except for the deep ventral sulcus, the valves chartaceous, shortly pilosulous to densely villous with curly, mixed pale and dark or largely dark hairs, the false septum produced so as to traverse the width of the cavity, 1.5–3 mm. wide; seeds dark brown, light brown or "black," 2–2.2 mm. in diameter.

KEY TO THE VARIETIES OF O. NIGRESCENS

1. Herbage loosely hirsute or pilose, the vesture early becoming, or from the first, thin, and the herbage greenish at maturity; plants densely cespitose to loosely matted, the branches of the caudex often elongating; leaflets (5) 9–15; coastal from Yukon at longtitude 138° to Alaska and Siberia................ a. var. *nigrescens*

— Herbage densely and permanently silky-canescent; plants very densely cespitose or pulvinate; leaflets 5–11; coastal from Baffin I. to Mackenzie at about longtitude 120°, and montane in northern British Columbia...... b. var. *uniflora*

5a. **Oxytropis nigrescens** (Pall.) Fisch. var. **nigrescens**

Oxytropis nigrescens (Pall.) Fisch. ex DC., Prod., 2:278. 1825. *Astragalus nigrescens* Pall., Astrag., 65, tab. 53. 1800. *Spiesia nigrescens* (Pall.) O. Kze., Rev. Gen., 206. 1891. *Oxytropis nigrescens* fma. *genuina* Kjellm., Vega-Exped. Vetensk. Arb., 16. 1883, nomen.

Astragalus pygmaeus Pall., Astrag., 66, tab. 54. 1800. *Oxytropis nigrescens* var. *pygmaea* (Pall.) Cham., Linnaea, 6:546. 1831. *O. pygmaea* (Pall.) Fern., Rhodora, 30:153. 1928. *O. nigrescens* subsp. *pygmaea* (Pall.) Hult., Fl. Alaska & Yukon, 1103, map 833a. 1947.

Aragallus bryophilus Greene, Proc. Biol. Soc. Wash., 18:17. 1905. *Oxytropis nigrescens* subsp. *bryophila* (Greene) Hult., Fl. Alaska & Yukon 1102, map 833. 1947.

Densely cespitose to loosely matted, the caudex-branches 1–8 cm. long, clothed with a thatch of (sometimes quite loosely) imbricated stipules; herbage hirsute with shining hairs, sometimes densely so in youth, or the vesture sparser, ascending rather than spreading, and then greenish; stipules 4–15 mm. long, at first sparingly pilose and ciliate distally, the broadly ovate to lance-acuminate free blades obtuse or acute, 1.5–8 mm. long, at length glabrous, straw-colored and shining; leaves (0.5) 1–4 (6) cm. long; leaflets (5) 7–15, commonly crowded on the rachis, oblanceolate to lanceolate or linear-elliptic, 1.5–7 (10) mm. long, both surfaces equally hirsute or the upper glabrous and only the margins bristly-ciliate; scapes 1–4 cm. long; racemes 1–4 (rarely 5, commonly 2) -flowered; calyx (5) 8–10 mm. long, the tube (3) 4.5–5.5 (6) mm., the teeth 2–4 mm. long; banner

12.5–20 mm. long, 7–12 mm. broad; keel 10–13 mm. long. *Type* collected by D. D. Merk, "inter Aldanum fl[umen] et orientalem Oceanum," i. e. eastern Siberia.

Distribution: Rocky ledges, often among lichen and mosses, Arctic shores and islands from coastal Yukon to Behring Strait, south to Shumagin and Kodiak islands, and montane in interior Yukon and Alaska; westward in Siberia at least to the Lena River, Yakutsk Prov., and south to Kamtchatka Peninsula and the Kurile Islands. Map 3.

Representative American specimens: ALASKA. St. Lawrence I., *Chamisso* (GH, fragment), *Mason 6105* (CAS, GH, NY). St. Matthew I., *Macoun 18510* (ND, type of *Aragallus bryophilus).* Teller Reindeer Station near Port Clarence, *Walpole 1861* (US). Kokrines, *W. B. Miller 1604* (US). Polychrome Pass, *A. & R. Nelson 3811* (GH, NY, US, WTC, WTU). Lake Iliamna Region, *Gorman 248* (NY). Kodiak I., *Piper 4449* (US, WTC), *Loof & Loof 292* (NY, fl. white). YUKON. Demarcation Point, *F. Johansen 98179* (NY). Herschell I., *Lindstrom in 1908* (NY). Lake Bennett, near summit of "Pinnacle," *Tarleton 10* (NY, US).

Following a pattern familiar in the genus, *O. nigrescens* varies greatly in stature, size of corolla, density of pubescence, and length of stipule. The larger and more loosely cespitose state corresponds well with Pallas's plate of *Astragalus nigrescens,* the smaller with that of *A. pygmaeus.* Chamisso, reporting both from St. Lawrence Island, subordinated *A. pygmaeus* as a variety of the other, pointing out that it differed principally in being more condensed—"habitu contractiori densiores offert caespites pulvinatos"; and he expressed doubt as to a difference in the pods as indicated by Pallas. Gray and Bunge went further, reducing *A. pygmaeus* entirely; and there the matter rested until 1928 when Fernald revived *O. pygmaea* as a species. More recently Hultén (Fl. Alaska, l. c.) has restricted typical *O. nigrescens* to northeastern Asia and established for the analogous American plant a subsp. *bryophila,* distinguished by less elongated caudex-branches rising from a central taproot and clothed with firmer, less pubescent, but more strongly persistent stipules. While I have not seen sufficient or sufficiently complete Asiatic material of *O. nigrescens* for analysis of variation in the species to the west of Behring Sea, it seems highly improbable that the typical race of the species should so far depart from the rule in the genus at large as to lack, as claimed, a "distinct conical central root." When the caudex-branches are elongated, as happens occasionally even in Alaska, the root of the plant is often not collected, and in this condition also the stipules and persistent leaf-bases are more exposed to weathering and therefore disintegrate more readily. The distinction between stipules dorsally pubescent when young and afterward glabrous (as given for subsp. *bryophila)* and "new stipules, and often the old ones . . . usually conspicuously brownish- or black-hairy" is not an especially firm one, or if significant we have by definition typical *O. nigrescens* in interior Alaska, and the supposed geographic segregation fails. No doubt definite trends in one or more directions can be made out from study of a large body of material, but in this case the criteria put forward seem too slight and too casual in their geographic occurrence to support convincing taxa above the rank of forma.

The characters emphasized by Fernald for *O. pygmaea,* lately upheld by Hultén as a further subspecies of *O. nigrescens,* were the subpulvinate habit and the stipules with ''short deltoid and obtuse tips . . . at first white-ciliate but soon . . . glabrate,'' and it was suggested that *O. nigrescens* proper, with ''conspicuously attenuate narrowly lanceolate and black-hairy stipule-tips,'' originating in Asia about ten degrees south and far west of the pulvinate arctic plant, could scarcely be conspecific. However we have loosely cespitose plants with attenuate stipules not only from St. Lawrence Island (whence typical *O. nigrescens* was reported by DeCandolle as early as 1825, by Kjellman, and others), but also from Kodiak, and from the Alaska Range in the interior. In some of these the stipules are purely white-hairy, in others there is an admixture of black hairs, and the latter cannot by any detail be separated from Siberian material. No further character can be found correlated with the length of stipules or with stature, and none has ever been made out in the flower or, since Pallas, in the fruit. According to Hultén's maps, the *pygmaea* phase is more northern and interior in Alaska, a fact no doubt connected with a more rigorous climate. Pallas, erroneously describing the pods of *A. nigrescens* and *A. pygmaea* as unilocular (although his figure of the latter clearly and correctly depicts a false septum traversing the width of the pod), stated that his two species differed, in a manner not precisely stated, in the legume. Nothing of significance has been found in the few fruiting specimens examined. Canescently hirsute and glabrescent foliage occur in both the loose and the pulvinate extremes of the species (cf. *G. N. Jones 9134, 9136,* from Nome, CAS), and the flower varies within the same limits in both. There is small advantage in maintaining the more condensed state on the arbitrary basis of stipule-length when intergradation into the loosely matted aspect is continuous and complete. I can see in *O. nigrescens, O. pygmaea,* and *A. bryophilus* no more than a single, superficially variable entity.

5b. **Oxytropis nigrescens** (Pall.) Fisch. var. **uniflora** (Hook.) Barneby

Oxytropis nigrescens (Pall.) Fisch. var. *uniflora* (Hook.), comb. nov. *O. arctica β uniflora* Hook., Parry's Second Voy., Append., 4:396. 1825.

O. arctica, varietas notabilis. R. Br., Chlor. Melvill., 254. 1823.

Oxytropis arctobia Bge., Gen. Oxytr. 114. 1874, exclus. syn. *O. nigrescens* var. *arctobia* (Bge.) Gray, Proc. Amer. Acad., 20:3. 1884. *Spiesia arctobia* (Bge.) O. Kze., Rev. Gen., 205. 1891. *Astragalus nigrescens* var. *arctobia* (Bge.) Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937.

O. arctobia var. *hyperarctica* Polunin, Bot. Canad. E. Arct., 293, Pl. 8. 1940.

Densely cespitose or pulvinate, the caudex-branches often becoming columnar from their dense thatch of marcescent stipules and leaf-bases; herbage densely and permanently silky-villous with subappressed and ascending hairs; stipules 4–9 mm. long, the deltoid to ovate free blades 1–3 mm. long, often glabrate in age; leaves 0.6–2 (3) cm. long; leaflets 5–9 (11), crowded, not more than 5 mm. long; scapes 3–21 mm. long; racemes 1–2-flowered; calyx 6.5–8 mm. long, densely shaggy-villous with predominantly black hairs, the tube 4.5–6 mm., the teeth 2–3 mm. long; corolla bright purple; banner 14–16 mm. long, the suborbicular blade 8–11.5 mm. broad; keel 10–11.5 mm. long; pod 1.7–3 cm. long, 6–8 mm. in diameter; seeds ochre or reddish-brown, perhaps sometimes black. *Type* collected on Parry's Second Voyage, at Barrow River (i. e. on the east coast of Melville Peninsula, lat. 67° 21′ N.); "*O. arctica β*, comm. Hook," (GH); *Parry*, comm. Greville in 1824 (NY); "*O. campestris, Parry*," comm. Hook. (NY), at least the first two probable isotypes!

Distribution: Arctic and subarctic shores, from Baffin Island to Mackenzie, and apparently also in the Rocky Mountains of northern British Columbia. Map 3.

Representative collections: Franklin. Gjöa Harbor, King William Land, *Lindström in 1904* (NY). Cape Dorset, Baffin I., *Soper 744* (GH). Arctic Bay, *Polunin 2583* (GH, isotype of var. *hyperarctica*). Mackenzie. Lelty Harbor, *Dutilly 392* (GH). Bernard Harbor, *Johansen 294* (GH, NY). Keewatin. Coral Harbor, Southampton I., *Malte 119782* (GH). British Columbia. Mt. Selwyn, 56° 1′ N., *Raup & Abbe 3907* (GH, NY), *3770* (NY).

Bunge's opinion that *O. arctobia* was "*O. nigrescenti* proxime affinis" has never been questioned and Gray, when he came to reduce it to varietal status, commented that it "evidently passes into *O. nigrescens*." However Fernald (Rhodora, 30: 152, 1928) maintained it as a species distinct from *O. pygmaea* (to which he then referred all western arctic American material of the *nigrescens* alliance) by reason of its broader stipule-blades, more dense and silky vesture, and relatively shorter calyx-teeth. We now have glabrescent "*O. pygmaea*" with short, broadly ovate blades to the stipules, and the length of the calyx-teeth fails to separate the more silvery eastern and glabrescent or hirsute western plants. There is no feature of the flower or pod unique to either. The similarities between *O. arctobia* and *O. nigrescens* are fundamental, while the differences in stature and vesture are relatively minor. The subordination of *O. arctobia,* advocated by Hultén (who considered it in Flora of Alaska and Yukon no more than a silky-villous race) seems to express the relationship admirably.

Apart from its outlying station in the northern Rockies, the variety has a natural and probably continuous range from Baffin Island westward to about longitude 124°. In the main area the plants are densely pulvinate, only rarely becoming a little looser in habit, as shown by Malte's gathering from Southampton Island. The material from Mt. Selwyn in British Columbia is decidedly larger in its vegetative parts, more loosely cespitose, and combines the silvery vesture characteristic of var. *uniflora* with the habit of var. *nigrescens.* The flowers, too, are exceptionally ample, and the calyx-teeth uncommonly broad. Fruiting material may perhaps reveal a distinct entity.

The var. *hyperarctica,* said to be distinguished by the glabrous inner surface of the broader pod-valves and by the paler, light-brown seeds, hardly differs significantly from the prevailing form of var. *uniflora.* In many species of *Oxytropis* the cavity of the fresh legume is traversed by filaments which dry out at maturity, and fall away at length, sometimes attached to the seeds. There are definite traces of such filaments in the isotype of var. *hyperarctica* cited, a plant collected in a condition of advanced fruit. The seeds of var. *uniflora* are commonly reddish-brown rather than ''black,'' and the slightly paler tint in var. *hyperarctica* seems doubtfully important. The valves of the pod are about 7 mm. broad when laid out in dehiscence, in fact of about average size for var. *uniflora.*

The variety was first indicated, as an unnamed form of *O. arctica,* in Chloris Melvilleana, and has been supposed by inference to occur on Melville Island. Brown's description was added to the account of *O. arctica* as an addendum and was probably based on material secured on Parry's Second Voyage (cf. discussion of *O. arctica).* Hooker, referring back to Brown's diagnosis, merely supplied a formal name and four words of description. There can be little doubt what either had in mind. In the Gray and Torrey herbaria there are several examples distributed by Hooker himself as ''*O. arctica β*, Parry,'' and these have been taken as authentic for the variety, even though none bears data of locality. *Oxytropis arctobia* was based on another specimen sent by Hooker under the label of *O. arctica β* to Fischer. It is unquestionably an exact synonym of var. *uniflora.*

6. **Oxytropis kokrinensis** Porsild

Oxytropis kokrinensis Porsild, Rhodora, 41:251, tab. 553. 1939.

Subpulvinate, the densely cespitose caudex-branches up to 3 cm. long, thickly beset with a thatch of imbricated stipules and persistent petioles; vesture of the herbage loosely silky-pilose, the hairs shining; stipules firm, 4–6 mm. long, castaneous becoming purplish-brown, at first sparingly pilose dorsally but early glabrate, the free blades deltoid, 1.2–2.5 mm. long, prominently 1-nerved, the margins bristly-ciliate; leaves 1–3 (5) cm. long, with slender, wiry petioles; leaflets 7–9, lance-ovate, conduplicate or with elevated margins, 2–7 mm. long; scapes shorter than the leaves, mostly 2-flowered; calyx thinly villous-hirsute, the campanulate tube 4–4.5 mm., the lanceolate teeth about 2.5 mm. long; corolla ''purple, 1–1.5 cm. long'' (ex char.) ; pod stipitate, the stipe about equalling the calyx-tube, the body oblong-ellipsoid, acute at both ends, slightly arched downward, 2–2.5 cm. long, 6–8 mm. in diameter, the valves papery, shortly pilosulous, the false septum produced across the width of the cavity, about 3 mm. broad. *Type* collected by A. E. and R. T. Porsild, in 1926, in the "Kokrines Mountains, divide toward Melotzina River, Alaska."

Distribution: Known only from the region of the type-collection. Map 2.

Collections examined: "Kokrinus," *W. B. Miller 1608* (US).

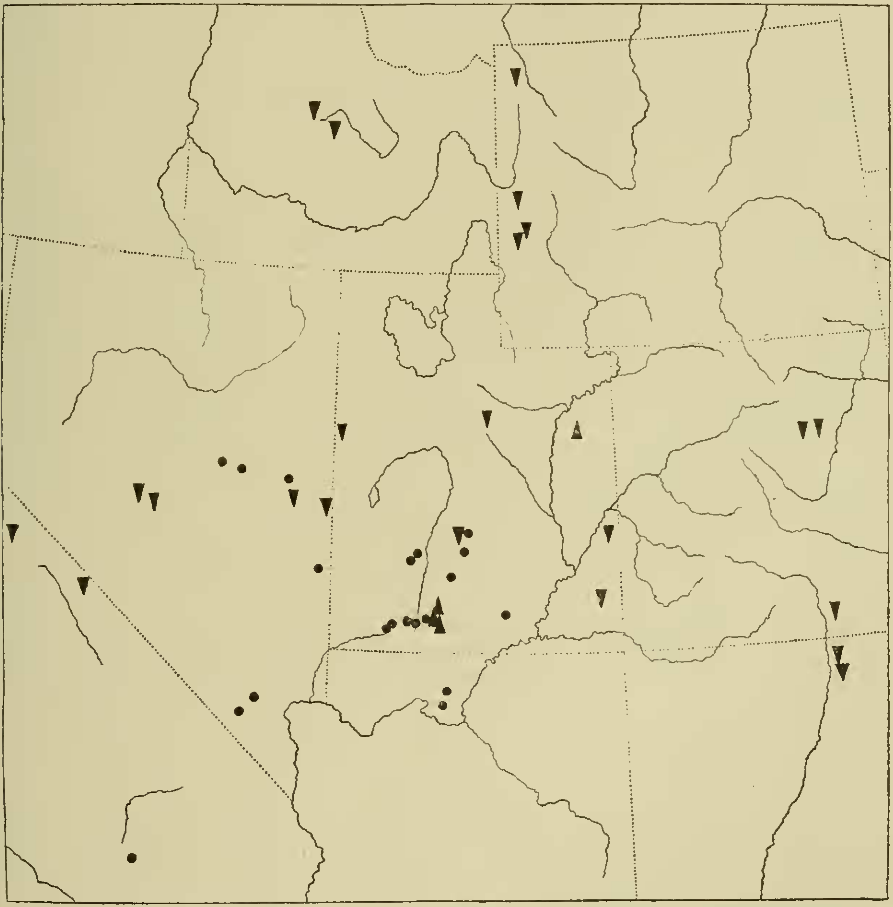
Neither of the Porsilds' collections *(no. 762,* type, *no. 761)* has been seen and the description here is based principally on the fruiting plant cited, which was also referred to *O. kokrinensis* by Hultén (cf. Fl. Alaska & Yukon, 1099, map 829, 1947). The species is amply distinguished from *O. nigrescens* by its stipitate pod, from *O. podocarpa* by its oblong, merely turgid and not bladdery-inflated pod, and from all our boreal species with few-flowered racemes by its chestnut-purple stipules.

The Kamtchatkan *O. rubricaudex* Hult. (Fl. Kamt., 3:110, fig. 14 a, b, Pl. 2, fig. e, f, 1929) which has similarly colored stipules, differs among other things in the glandular-margined stipules, leaves with 17–21 leaflets, and sessile pod only about 1.5 cm. long.

7. **Oxytropis oreophila** Gray

Oxytropis oreophila Gray, Proc. Amer. Acad., 20:3. 1884. *Spiesia oreophila* (Gray) O. Kze., Rev. Gen., 206. 1891. *Aragallus oreophilus* (Gray) A. Nels., Erythea, 7:59. 1899. *Astragalus oreophilus* (Gray) Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937; non Reiche (1897), nec. Rydb. (1904). *Astragalus Munzii* Wheeler, Leafl. West. Bot., 2:209. 1939.

Cespitose or pulvinate, mature plants consisting of half a dozen to more than a hundred crowns, the caudex then becoming intricate and woody, supporting dense cushions 1–3 dm. in diameter; herbage densely silky-pilose, the hairs appressed and loosely ascending, sometimes sparsely pilose and greenish; stipules scarious, 4–12 mm. long, silky-pilose dorsally but commonly glabrate in age, especially distally, the free blades 1–5 mm. long; leaves 1–8.5 cm. long, erect or spreading (in more compact forms densely resulate, and the petioles marcescent as a thatch on the lengthening caudex-branches), with 7–17 lanceolate, elliptic, rarely ovate, acutish or obtuse, commonly conduplicate leaflets 3–9 (12) mm. long, equally pilose on both faces, when large thinly so and greenish; scapes erect, sigmoid-ascending or prostrate, 0.5–12 cm. long, much shorter than, equalling or far surpassing the leaves, sparingly ascending-pilose to copiously hirsute; racemes subcapitately 2–12-flowered, the axis scarcely elongating, not more than 1 cm. long in fruit; bracts lanceolate to linear-lanceolate, 2.5–8 mm. long, pilose dorsally; flowers spreading-ascending on slender, at length disarticulating pedicels 0.5–2.5 mm. long; calyx campanulate 4.5–7.5 (8) mm. long, villous-hirsute with shorter dark and longer pale hairs in varying proportions, the tube (3.2) 4–5.5 mm., the linear-subulate teeth (1.3) 1.8–2.5 mm. long; corolla pink or purple, exceptionally white, drying bluish; banner obovate 8–12.5 mm. long, 4–7.5 mm. broad; wings 7–10.5 mm. long, the obliquely oblong-oblanceolate blades 5–7 mm. long, little dilated upward, 1.5–3 mm. broad near the truncate or obscurely emarginate apex; keel 5.5–9 mm. long, the straight or recurved appendage 0.5–1 mm. long; pod sessile or nearly so, bladdery-inflated, 9–17 mm. long, the suborbicular to ovoid, slightly obcompressed, ventrally sulcate body passing gradually or abruptly into a deltoid or acuminate, nearly straight or strongly declined, laterally compressed beak 1.5–5 mm. long, the valves membrano-chartaceous, hirsutulous to densely villous with pale (and often also some shorter fuscous) hairs 1–2 mm. long, inflexed along the ventral suture to form a narrow false



Map 4. Ranges of *Oxytropis oreophila* ●; *O. Jonesii* ▲; and *O. Parryi* ▼.

septum 0.3–1 mm. wide; seeds brown, 1.6–1.8 mm. in diameter. *Type* collected by L. F. Ward, in 1875, in the "mountains of Utah (Aquarius Plateau at nearly 10,000 feet)"; Aquarius Plateau, Garfield County, Utah, *L. F. Ward 541* (GH)!

Distribution: Dry rocky crests above timberline, gravelly places in open pine-forest, barren knolls in sagebrush valleys, more rarely in mountain parks or on stony lake shores, between 5600 and 11,500 ft. altitude, from the plateau region of south-central Utah to the Kaibab, Arizona, and across central and southern Nevada to the San Bernardino Mountains, California. Map 4.

Representative collections: CALIFORNIA. Mt. San Gorgonio, San Bernardino County, *Abrams & McGregor 754* (GH, NY). NEVADA. Charleston Peak, Clark County, *Clokey 5517* (CAS, GH, NY, POM, RB, WTC). Monitor Valley near Lone Mt., *Ripley & Barneby 6214* (CAS, GH). UTAH. Near Cedar City (labelled "s. Utah," but cf. Amer. Nat., 9:203, 270, 1875, under *O. campestris* var.?), Iron County, *Parry 55* (GH, NY). Mt. Ellen, Henry Mts., Garfield County, *M. E. Jones 5674* (NY, POM, US). ARIZONA. V. T. Park, Kaibab Forest, Coconino County, *Goodman & Hitchcock 1626* (CAS, NY).

Oxytropis oreophila is a most instructive species, displaying a degree of variability and a sensitivity to environment unsurpassed by many a more widely ranging species so that it presents, in a relatively small and compact area, most of the problems encountered in the genus at large. The principal modes of variation can be described as xerophytic and mesophytic. In the first there is a tendency toward reduction in length of peduncle, in amplitude of foliage, and in number of flowers to the raceme, while the bracts become short and narrow, and the caudex stout, intricately branched and clothed in a thatch of marcescent leaf-bases. The extreme in this direction is a pulvinate cushion with flowers and pods, two or three to a stem, resting at the level of the leaves or embedded in them, and it occurs not only above the limit of trees, as on the summits of the San Bernardino Mts., but also between six and seven thousand feet in the pseudo-alpine environment of barren knolls in the valleys of central Nevada and southern Utah. The relatively mesophytic opposite, especially well developed in the parks of the Kaibab Plateau, and on lake shores in the mountains of Utah, is a more slender plant composed of a few crowns almost naked of marcescent petioles, with elongate, erect scapes bearing several-flowered racemes lifted well above the leaves, while the bracts become larger or even foliaceous, and the vesture of the stipules and of the more ample leaflets is thinner and less silvery. At intermediate levels, as the plants descend from the summit screes into richer soils and more protected sites in the timber belt, the distinctive aspect of the alpine state is diminished, each character varying independently of others into the opposite condition. Large collections from any one station show something of the same variation. Thus Mr. Howell's fine series from Mt. San Gorgonio *(J. T. Howell 23668*, CAS, RB) includes densely pulvinate mats as well as looser individuals with exserted peduncles. In the region of Bryce Canyon, Utah (Red Canyon, *Ripley & Barneby 8546)*, gnarled, woody-caudexed cushions were found on open gravel ridges which, seeding down into a wash among the yellow pines, gave rise to lax and slender tufts with obscurely developed caudex, longer and more ample leaves and larger flowers. The Charleston Mt. material, from "broken rock just below timberline," combines the condensed foliage and few-flowered raceme of the alpine state with scapes as long, though prostrate, as found in the mesophytic extreme. Conversely diminutive plants from Hatch, Utah *(Pierson 12606*, RB), are long-bracted and many-flowered. Since like diversity, little or not at all correlated with habitat or distribution, exists in length of calyx-teeth, length and width of petal, in outline of pod, and in other characters, it seems impossible to recognize in *O. oreophila* more than a single plastic species.

Oxytropis oreophila was described from Ward's Utah material and from two collections *(W. G. Wright in 1879*, GH; *Lemmon 1470*, GH) from the San Bernardino Mts., California. Wheeler (l. c., sub *Astragalo Munzii)* has designated *Ward 541* as lectotype, a choice that is readily accepted. Apart from a mistaken record from Idaho (Rydb., Fl. Rocky Mts., 520, 1917) there has been no confusion as to the range or identity of *O. oreophila*. Gray's "possible variety . . . or related species, with flowers immersed in the tufts of foliage" (Proc. Amer. Acad., 20: l.c.) alludes to *Ward 574* (GH, US), from Rabbit Valley, Utah, which represents the condensed form of low altitude (in this case about 6800 ft.) mentioned above. The specimens, to which Gray gave an unpublished varietal name with the pencilled query, "an *oreophila* pedunculis brevissimis?" have unusually small flowers and short calyx-teeth. Except for these characters, quite variable in the species, the material well matches *Ripley & Barneby 4753* from 6700 ft. in eastern Sevier County, Utah, about twenty miles north of Rabbit Valley.

The species closely resembles *O. Parryi*, which varies in parallel, though less extreme, fashion. The latter is distinguished by the narrow, coriaceous pod and constantly few-flowered raceme. A form of *O. Lagopus* var. *atropurpurea* with uncommonly short, subglobose and inflated pod bears a strong resemblance to some states of *O. oreophila*, but differs in the much larger corolla with dilated wing-petals.

8. **Oxytropis Jonesii** Barneby, new species

Oxytropis Jonesii, sp. nov. ex affinitate *O. oreophilae* Gray, cujus a formis et maxime congestis et paucifloris corolla legumine necnon seminibus majoribus, foliolis paucis tantum 1–3-jugis, aliisque notulis diversa. — ? *O. multiceps* var. *minor* sensu Graham, Ann. Carn. Mus. 26:256. 1937; non Gray.

Herba acaulescens densissime pulvinata, caudicis multicipitis lignei ramulis crassis 1–5 cm. longis stipulis marcidis arcte indutis columnaribus; foliis rosulatis 0.7–2 cm. longis suberectis, pilis argenteis patulis vel adscendentibus ubique sericeis; stipulis ad 6 mm. usque longis, petiolo brevissimo alte adnatis, extus pilosis vel laminis liberis deltoideis 1–1.5 mm. longis piloso-ciliatis dorso nonnumquam glabratis; foliolis 1–7 ellipticis obtusiusculis 2–5 (7) mm. longis, subpalmatim congestis vel rachi ad 6 mm. usque longo producto pinnatis; pedunculis piloso-hirsutis 0.3–1 (2.5) cm. longis folia rarissime superantibus; racemo 1–3 (5) -floro, subcapitato, fructifero haud elongato, floribus patulis; bracteis lineari-oblanceolatis 2–5 mm. longis, extus pilosis; pedicellis 0.5–2 mm. longis; calycis profunde campanulati pilis brevibus fuscis longisque argenteis commixtis dense piloso-hirsuti tubo (4.5) 5–7 mm. longo demum rupto, dentibus deltoideis vel ovato-subulatis 1.5–2.5 mm. longis; corolla violaceo-purpurea; vexillo late oblanceolato vel obovato 14.5–16 mm. longo, 6–9 mm. lato, emarginato; alarum 14–16 mm. longarum limbo oblique dilatato truncato vel leviter retuso 3.5–5 (6) mm. lato, auriculo (2 mm.) incluso 8–9 mm. longo; carinae 11–12.5 mm. longae laminis (appendiculo subulato subrecto circa 1 mm. long incluso) 6–7 mm. longis; legumine sessili vel subsessili (stipes saepissime obsoleta raro 0.6 mm. usque longa producitur) ovoideo vesicario-inflato, paullo obcompresso, 1.5–2.5 cm. longo, in rostrum conico-deltoideum compressum 2–4 mm. longum leviter declinatum abruptiuscule angustato, ventraliter sulcato, valvulis chartaceis, villis patulis pallidis (saepissime brevioribus pullis adspersis) hirsutulis, secus suturam ventralem anguste inflexis ut alam intus productam 1.2–2 mm. latam efforment; ovulis numerosis; seminibus fusco-castaneis 2.8–3 mm. longis. *Type:* pink calcareous gravel benches, Red Canyon, Garfield County, Utah, alt. 7150 ft., 7 June 1947, fl. & fr., *Ripley & Barneby 8550,* in Herb. Calif. Acad. Sci. *No. 337311:* isotypes GH, NY, WYO.

Distribution: Bare gravelly knolls and ridges, on shale or limestone, alt. 6300–7750 ft., Paunsagunt and East Tavaputs plateaux, Utah, Map 4.

Specimens examined: UTAH. Red Canyon, 10 mi. w. of entrance to Bryce Canyon, *C. L. Hitchcock 2964* (WTU). 2 mi. w. of Bryce Canyon, *Degener 16442* (NY). Bryce Canyon, *M. E. Jones in 1919* (POM). *Eastwood & Howell 728* (CAS). Widtsoe, foothills of Escalante Range, *Ripley & Barneby 8572* (CAS). Watson-Ouray road, 5 mi. w. of Bitter Creek, Uintah County, *E. H. Graham 8989* (GH, US).

Oxytropis Jonesii is clearly related to, and perhaps derived from *O. oreophila,* the most dwarf and pulvinate, few-flowered states of which are similar in appearance. The greater size of the flowers and fruits, combined with leaves reduced both in amplitude and in number of leaflets, distinguish it immediately. It was at first suspected that the early collections represented no more than a modification of the plastic *O. oreophila* to the peculiar

environment of naked limestone benches on the Paunsagunt Plateau; but in Red Canyon a colony of typical *O. oreophila,* with well-furnished racemes of small flowers, developed peduncles and elongate 9–11-foliolate leaves, was found growing under apparently identical conditions a few paces from the group of plants from which the type of *O. Jonesii* was taken. In Garfield County, where *O. Jonesii* has been met with in half a dozen stations, the species is abruptly confined to ridges of the pink Wasatch limestone where it forms densely packed cushions of silvery foliage 1–3 dm. in diameter, liberally decorated with almost stemless violet flowers or the dusky bladders of the fruit. It is associated with several narrow regional endemics of other genera, such as *Lomatium minimum, Townsendia minima, Silene Petersonii* var. *minor, Eriogonum aretioides,* and *Draba subalpina,* and a distribution similar to theirs might be expected. It may be that the *Oxytropis* from the Green River shale in southern Uintah County belongs to a distinct race or species. The material is young and does resemble *O. multiceps* var. *minor* to which Graham referred it, but the broad floral bracts characteristic of *O. multiceps* are lacking. Apart from slightly more numerous (2–5) flowers to the raceme, the plants from this outlying station seem an excellent match for those to the west. Certain identification must await discovery of the fruit.

Oxytropis Jonesii is dedicated to the memory of Marcus Eugene Jones, pioneer botanist in the Great Basin and monographer of American *Astragalus,* who discovered the species in 1919.

9. **Oxytropis Parryi** Gray

Oxytropis Parryi Gray, Proc. Amer. Acad., 20:4. 1884. *Spiesia Parryi* (Gray) O. Kze., Rev. Gen., 206. 1891. *Aragallus Parryi* (Gray) Greene, Pittonia, 3:211. 1897. *Astragalus Parryanus* Tidestr., Proc. Biol. Soc. Wash., 50:19. 1941 (as *"parryanus"); non A. Parryi* Gray.

Low and densely cespitose, the several crowns clustered on a taproot, the branches of the caudex densely clothed with a thatch of persistent petioles and leaf-bases; herbage densely silky-pilose throughout, canescent or tawny in age, the hairs loosely to strictly appressed; stipules membranous becoming chartaceous, at first connate opposite the petiole but early ruptured, pilose dorsally, or the triangular to shortly acuminate ciliate free blades (2–4 mm. long), especially of those subtending secondary leaves, at length glabrate; leaves (1.5) 2.5–7 cm. long, somewhat dimorphic, erect or spreading, the petioles 0.5–2.5 (3) cm. long; leaflets 9–15 (17), narrowly oblong, elliptic or ovate, acutish or obtuse, 2.5–12 mm. long, flat or involute-conduplicate, commonly crowded and subcontiguous; scapes either strict, sigmoid-arcuate, ascending or prostrate, 2.5–7.5 (10) cm. long, equalling or surpassing the leaves, appressed-pilose but often bearing a few loosely ascending hairs, especially below the inflorescence; racemes subcapitately 1–3, usually 2-flowered, the flowers nearly erect; bracts lanceolate, acutish or obtuse, 3–7 mm. long, pilose dorsally; calyx deeply campanulate, 5–8 mm. long, densely hirsute with mixed short dark and longer pale hairs, the early ruptured tube 3–5.5 mm., the teeth 1.5–2.5 mm. long; corolla dull purplish; banner obovate, 7.5–10.5 mm. long, 3–5 mm. broad near the emarginate apex; wings 8–9 mm. long, the blades oblong or obliquely elliptic, about 5.5 mm. long, 2–2.5 mm. broad near the truncate or obtuse apex; keel 8–9 mm. long, the blades 4.5–5 mm. long including the small conic or subulate appendage; pod erect, sessile, lance-ovoid or narrowly oblong-acuminate in outline, 13–22 mm. long, 4–6 (8) mm. in diameter, the body passing upward into a short, slightly divaricate or straight beak, a trifle obcompressed, deeply sulcate ventrally, the valves chartaceous and stiff at maturity, shortly and densely pilosulous and strigose with mixed pale and dark hairs, the ventral suture produced inward as a false septum 1–2 mm. wide, almost or quite traversing the chamber; seeds dark-brown, 1.8–2 mm. in diameter. *Type* collected by C. C. Parry, in 1867, in the "Rocky Mountains of northern New Mexico and Colorado, near the limit of trees," more precisely at Sangre de Cristo Pass, Taos County, New Mexico; *Parry 41* (GH)!

Distribution: Stony ridges and screes, above or rarely below timberline, altitude 8900–12,000 ft., in the mountains surrounding and within the Great Basin, from northwestern Wyoming and central Idaho to transmontane middle California and northern New Mexico. Map 4.

Representative collections: IDAHO. E. of Castle Peak, Custer County, *Hitchcock & Martin 10880* (CAS, NY, WTC, WTU). WYOMING. Piney Mt., Sublette County, *E. & L. Payson 2706* (GH, NY, POM). CALIFORNIA. Inconsolable Range above Thunder and Lightning Lake, Inyo County, *J. T. Howell 24115* (CAS, RB). Mt. Patterson, Sweetwater Mts., Mono County, *Alexander & Kellogg 4545* (UC). NEVADA. Toiyabe Dome, Nye County, *Maguire & Holmgren 25995* (NY, RB, WTC). Wheeler Peak, White Pine County, *McVaugh 6028* (UC). UTAH. Scofield, Carbon County, *M. E. Jones in 1904* (CAS, NY). La Sal Mts., *E. & L. Payson 2706* (GH, NY). COLORADO. Little Veta Mt., Huerfano County, *Rydberg & Vreeland 5998* (ND, NY). Fairplay, Park County, *Ripley & Barneby 10375* (CAS). NEW MEXICO. Pecos Baldy, Mora County, *V. Bailey 616* (US).

With its oblong, erect legume and subcapitate raceme of one to three tiny purplish flowers, *O. Parryi* is distinct and almost unmistakable. In general facies it most closely resembles *O. oreophila*, varying like that species in the orientation of the scapes, in the amplitude of the leaflets, and to some degree in the size of the calyx and corolla; but the pod is much narrower, bilocular or nearly so, and of a thicker and tougher texture. In the high Rocky Mountains the ranges of *O. Parryi* and the Arctic-Alpine *O. podocarpa* overlap. Although the raceme of *O. podocarpa* is also reduced to about two flowers, the corolla is much larger than that of *O. Parryi* (the banner about 15 mm. long), the vesture is different, and the pod is stipitate and bladdery-inflated.

The species was first collected, in fruit, by Hall and Harbour in 1862, and distributed with flowering material of *O. podocarpa* under the same *No. 143* (GH, NY). Gray at first referred it (Proc. Philad. Acad., 1863, p. 61) to *O. arctica*, at that time unknown to him, and subsequently (Proc. Amer. Acad., 6: 235, 1864) to *O. uralensis* var. *pumila*, a name used to cover a miscellany of dwarf and imperfectly understood species. Finally *O. Parryi* came to be based on specimens collected by "Parry, Hall, & Harbour, Greene": of them the first cited, *Parry 41* in the Gray Herbarium, is the obvious lectotype.

Like some other members of the genus, notably *O. viscida*, *O. Parryi* is characteristically a plant of great altitudes, where it occurs in open stony ground near timberline; but it is also found much lower, well down in the Arid Transition zone. During an ascent of Ward Mountain in eastern Nevada, *O. Parryi* was encountered in some abundance on broken limestone outcrops two or three hundred feet below the main forest belt *(Ripley & Barneby 4014*, CAS). Such small denuded areas surrounded by sagebrush and exposed to high winds and extreme drought are probably similar microclimatically to the subalpine screes generally preferred by the species.

10. **Oxytropis multiceps** T. & G.

Oxytropis multiceps T. & G., Fl. N. Amer., 1:341. 1838. *Physocalyx multiceps* Nutt. ex Gray, Proc. Amer. Acad., 6:234. 1864, in syn. *Spiesia multiceps* (T. & G.) O. Kze., Rev. Gen., 206. 1891. *Aragallus multiceps* (T. & G.) A. Hell., Cat. N. Amer. Pl., 4. 1898. *Astragalus bisontum* Tidestr., Proc. Biol. Soc. Wash., 50:18. 1937 (as "*Bisontum*").

Oxytropis multiceps var. *minor* Gray, Proc. Amer. Acad., 20:2. 1884. *Aragallus multiceps* var. *minor* (Gray) A. Nels., Erythea, 7:57. 1899. *Aragallus minor* (Gray) Ckll. ex Daniels, Univ. Mo. Sci. Stud. II, 2:158. 1911. *Oxytropis minor* (Gray) Ckll., Torreya, 18:180. 1918, nomen (without citation). *Astragalus bisontum* var. *minor* (Gray) Tidestr., Proc. Biol. Soc. Wash., 50:18. 1937.

Dwarf and cespitose, the pluricipital caudex more or less invested with marcescent stipules and petioles; herbage silky-pilose, silvery or sometimes greenish, the petioles scapes and stipules variably ascending-pilose; stipules membranous, pale, amplexicaul but never connate, lanceolate or ovate-lanceolate, 4–14 mm. long, the deltoid to lanceolate free blades (2) 3–6 mm. long, the whole hirsute or silky-pilose dorsally, rarely becoming glabrate, at length chartaceous-persistent; leaves 1–5 cm. long, the slender petioles 0.5–2.5 cm. long; leaflets 5–9, lanceolate, oblanceolate, elliptic, or ovoid-oblong, acute or rarely obtuse, (3) 5–13 mm. long, disposed on a rachis scarcely longer than the lowest pair; scapes spreading and at length prostrate, 1.5–3 cm. long, equalling or commonly surpassed by the leaves;

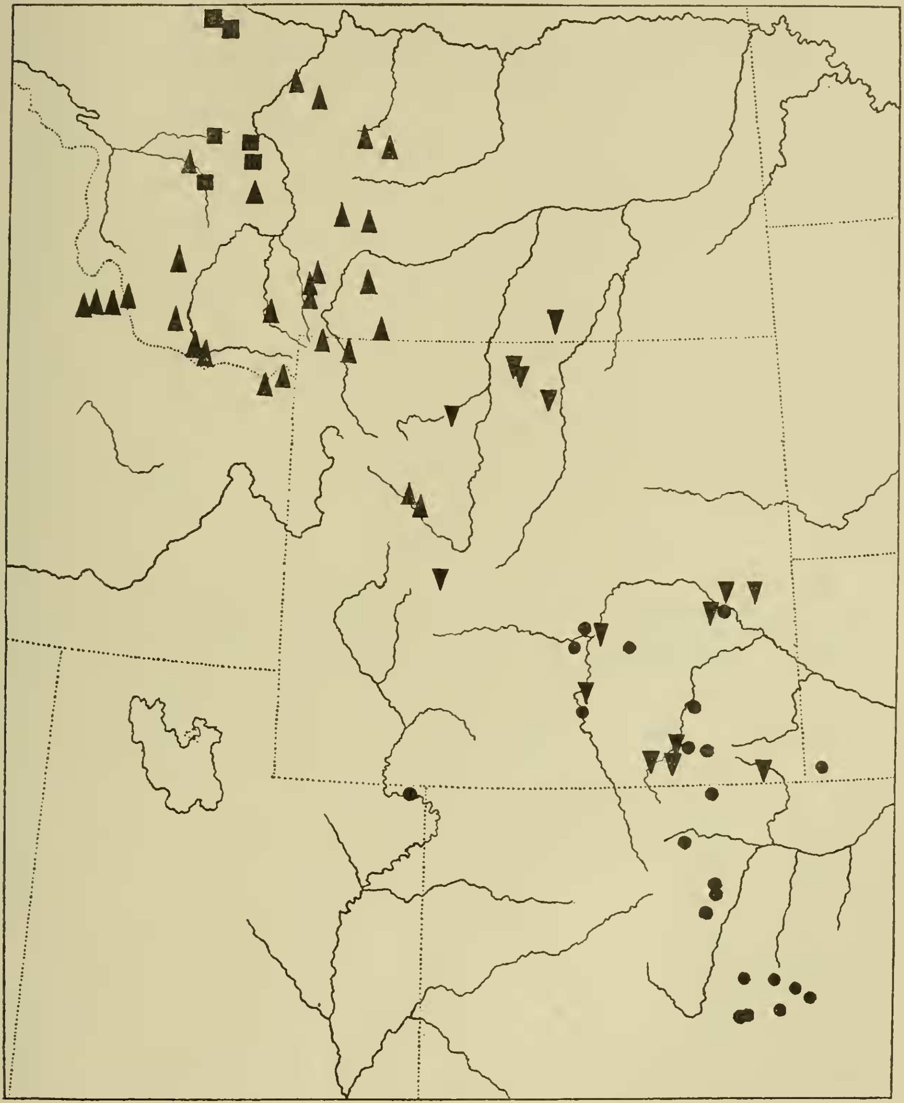
racemes subcapitately (1) 2–4-flowered, the axis not exceeding 5 mm. in length; bracts herbaceous, ovate or broadly lanceolate, obtuse to shortly acuminate, (3) 5–7 mm. long, thinly pilose or rarely glabrescent dorsally; pedicels slender, 1–1.5 mm. long, articulate at base and deciduous with the calyx; calyx strongly turgid at anthesis, somewhat attenuate at base, membranous, reddish and densely villous-hirsute with white hairs, the tube 5.5–10 mm., the unequal teeth 2–3 mm. long, in fruit becoming bladdery-inflated, 8–18 mm. long, 5–9 mm. in diameter, constricted at the mouth, the teeth erect or connivent; corolla bright pink-purple with a striate diamond in the banner, drying bluish; banner 17–24 mm. long, the broadly oblong-obovate emarginate blade about 9 mm. broad; wings dilated upward and 4.5–5.5 mm. wide near the emarginate apex; keel 13–18.5 mm. long, the blades, including the straight or recurved appendage (0.5–1.2 mm.) obliquely elliptic, 6–7 mm. long; pod included in the calyx and falling with it, stipitate, the stipe 0.5–1.5 mm. long, the ovoid-ellipsoid body 6–10 mm. long, contracted into a straight subulate beak up to half as long, somewhat dorsoventrally compressed and sulcate ventrally, 3–5 mm. in diameter, the valves thinly chartaceous, short-villous, the ventral suture produced inward as a flange 0.5–1 mm. wide, forming a partial false partition; seeds dull, orange- or pinkish-brown, sometimes purple-speckled, 1.5–2.1 mm. in diameter. *Type* collected by Thomas Nuttall, in 1834, on the "summit of lofty hills in the Rocky Mountain range, towards Lewis's River," i. e. southern Wyoming; "Rocky Mts," *Nuttall* (PH, GH, NY)!

Distribution: Gravelly summits and bare ridges between 6,000 and 10,200 ft. altitude, commonly on decomposed granite but also in detrital clays and sand, from southeastern Wyoming and adjacent Nebraska southward on the Atlantic slope to the Arkansas-South Platte divide in central Colorado, and westward to the Green River and the north slope of the Uinta Range in Utah. Map 5.

Representative collections: WYOMING. Crow Creek, Albany County, *A. Nelson 8969* (CAS, GH, NY). Fort Steele, Carbon County, *Tweedy 4199* (NY, US). NEBRASKA. Upper Lawrence Fork, Kimball County, *Rydberg 52* (NY, US). UTAH. Mann's Ranch near Flaming Gorge, Daggett County, *L. O. Williams 536* (NY). COLORADO. Without locality, *Hall & Harbour 144* (GH, NY, US). Headwaters of Clear Creek, Clear Creek County, *Parry 991* (GH, type of *O. multiceps* var. *minor,* NY). Caribou Mine, Boulder County, *Clokey 3279* (CAS, NY, POM, US, WTC). E. of Calhan, El Paso County, *Ripley & Barneby 7727* (CAS).

With its inflated calyx, broad bracts, loosely few-flowered raceme and few leaflets, *O. multiceps* is among the most distinctive species of the genus, yet it exhibits to some extent the variability characteristic of its kind. Here again are pygmy and giant phases, differing in size of calyx, petals, stipules, and leaflets. When Gray described the var. *minor,* he possessed only the

Nuttall type (with fruiting calyx 12 mm. and leaflets 6–10 mm. long) and a few examples of the dwarf extreme from the mountains (at about 10,000 ft.) of Colorado, these having the calyx 8–10 mm. and leaflets 3–7 mm. long. Subsequent collections have shown that these are no more than steps in an uninterrupted sequence, in which Nuttall's plant holds a central and representative position. If var. *minor* is maintained, logic demands a "var.



Map 5. Ranges of *Oxytropis multiceps* ●; and *O. Lagopus:* var. *Lagopus* ▲; var. *conjugans* ■; var. *atropurpurea* ▼.

major" for the opposite extreme, which differs from the type to the same degree. Lines of demarcation would be entirely arbitrary, and it seems best to accept all our material as belonging to a single variable entity. Some inconstancy in vesture may be noted also. On the desert plateaux of Wyoming, the stipules, petioles, and scapes are inclined to be more loosely and copiously hirsute than elsewhere in the range of the species. But complete intergradation into a sparser and more nearly appressed pubescence is apparent.

Oxytropis multiceps has been well understood from early days. Watson's report of it from Montana (Bot. King, Append., 446, 1871) was based on specimens of *O. Lagopus,* similar in the inflated and deciduous calyx. A record of var. *minor* from the Navajo Basin in Utah is discussed under the heading of *O. Jonesii,* above. The plants from the Flaming Gorge in northeastern Utah, already cited, were distributed by Williams under an unpublished binomial; except for the large calyx, sometimes exceeded at the other end of the species-area in Colorado, they are characteristic *O. multiceps.*

The binomial *O. multiceps* has been attributed from the first to Nuttall. It is true that the original description was taken from Nuttall's notes, but all parts of the type collection are labelled *Physocalyx multiceps* in the collector's hand, a genus which was never published. It seems probable that the species was referred to *Oxytropis* by the authors of the Flora of North America, rather than by Nuttall himself, and should be so cited.

11. **Oxytropis Lagopus** Nutt.

Low and densely cespitose, the several crowns clustered on the summit of a simple or forking taproot, the herbage everywhere silky-pilose with long silvery ascending or somewhat spreading hairs; stipules membranous and pale, at first connate opposite the petiole, but early ruptured, 7–17 mm. long, densely silky-pilose dorsally, or the deltoid to broadly lanceolate, ciliate blades (2–7 mm. long) sometimes glabrate in age, the whole at length chartaceous-persistent; leaves commonly dimorphic, (0.7) 1.5–11 cm. long, the more or less hirsute or villous petioles (0.3) 1–5 cm. long; leaflets 5–17, fewer and broader on the primary than on the secondary leaves, ovate-oblong to narrowly elliptic, acute or obtuse, involute or flat with elevated margins, 3–15 mm. long; peduncles erect, arcuate-ascending or subprostrate, 1–13 cm. long, closely appressed-pilose to copiously and finely villous-hirsute with horizontal hairs; racemes (3) 5–18-flowered, subcapitate to oblong at full anthesis, little elongating in fruit, the axis at maturity 0.5–3 (4) cm. long; bracts ovate-acuminate or lanceolate, 3–15 mm. long, somewhat involute and boat-shaped, densely shaggy-pilose dorsally, often with some dark hairs; pedicels slender, 1 mm. long or less, in fruit either firmly attached to the axis or articulate and readily deciduous; calyx at anthesis 8–11 mm. long, the deeply campanulate tube 5.5–7 mm., the linear-subulate teeth

2–4.5 mm. long, heavily silky-hirsute with all white, mixed, or largely dark shining villi which conceal the surface of the tube, in fruit becoming slightly turgid to strongly inflated and thus variably accrescent, either ruptured by the growing fruit or not; petals brilliant pink-purple or bluish-purple; banner 14–19 mm. long, the broadly ovate to ovate-oblong, deeply emarginate blade 7–10 mm. wide; wings 13–16 mm. long, variably dilated upward and 2–6 mm. wide near apex; keel 11–14 mm. long, the blades, including the subulate appendage, 6–7 mm. long; pod erect, either wholly enclosed in or far exserted from the calyx, shortly stipitate or sessile, ovoid to narrowly oblong, turgid to much inflated, ventrally sulcate and somewhat obcompressed, the body 6–15 mm. long, 4–6.5 mm. in diameter, passing abruptly or gradually into a straight or strongly divaricate beak 3–5 mm. long, the valves chartaceous to submembranous, the ventral suture produced inward as a narrow or rudimentary false septum 0.5–1 (1.5) mm. wide; seeds drab-, chestnut- or olive-brown, dull, 1.6–2 mm. in diameter.

In Montana and Wyoming, extending at middle altitudes from the upper Missouri about Great Falls and Helena south to Cheyenne and the Laramie plains, there are three similar and evidently related dwarf species of *Oxytropis* passing under the names *O. Lagopus, O. Blankinshipii,* and *O. atropurpurea.* In the *Flora of the Rocky Mountains,* Rydberg (sub *Aragallo)* placed *O. atropurpurea* in section *Campestres,* characterized by a pod at length exserted from a ruptured calyx, and the other two in section *Nani,* distinguished by inflated calyx and included pod; although *O. Lagopus,* on account of its ''somewhat exserted'' legume was keyed in both sections. From these keys it appears that *O. lagopus* should differ essentially from *O. atropurpurea* in the darker color of the petals and calyx-hairs, and from *O. Blankinshipii* in the longer pod and spreading-villous scape. Strict application of these criteria results in an artificial arrangement. It is possible to sort the material into three distinct groups, but these cut right across the lines laid down by Rydberg. The most distinctive entity, to which belong the type of *O. Blankinshipii* and, almost beyond a doubt, the original *O. Lagopus* of Nuttall, is the prevailing member of the alliance along the forks of the Missouri in southwestern Montana and the Yellowstone region. Here the pod is not only included in an inflated calyx but is early deciduous with it, the pedicels being jointed to the axis and deciduous before dehiscence of the fruit. Individual plants with this type of fructification, and surely conspecific, may have scapes appressed-pilose, sparsely hirsute with ascending hairs, or copiously villous, the villous state being a mark of *O. Lagopus* in Rydberg's sense. To the south, almost entirely within Wyoming, the true *O. Lagopus* is replaced by a plant, altogether similar in facies, herbage, and flower, but with pod well exserted, rupturing the feebly distended calyx and persistent at least until dehiscence. Here the scapes are commonly long-villous but may be appressed-pilose, and the calyx is often, though by no means always, pubescent with dark hairs. The nigrescent phase corresponds with Rydberg's *O. atropurpurea,* the rest with his *O. Lagopus.*

It should be emphasized that these two races, variable as they are in parallel directions, are indistinguishable in early anthesis. In each, the secondary leaves are lanceolate in outline, and the leaflets number between nine and seventeen (rarely seven in the primaries), and are well distributed along the rachis. But the fruit is in each case characteristic, and they might almost be maintained in the rank of species, were it not for the occurrence toward the northern limit of true *O. Lagopus,* within the range, in fact, of that species, but disjunct from that of *O. atropurpurea,* of a troublesome intermediate form. This, described below as var. *conjugans,* has exactly the corolla and young calyx of the two preceding, but the leaflets are fewer, commonly large and more congested on the rachis, resulting in a leaf of broadly oblong outline, and the entire plant is yet more copiously villous with exceptionally long, almost arachnoid hairs. In plants of this type, known only from a restricted area in western Montana, the calyx may either become strongly inflated and enclose the pod, or only a little turgid and at length ruptured by the exserted pod. The whole fruit is persistent at least until dehiscence, as in *O. atropurpurea,* but in form breaks down the last distinctions between that species and typical *O. Lagopus.* Since the corolla, young calyx, and (in all but length and degree of inflation) the pod of these three races are identical, it seems best to unite them as varieties under a common specific name.

KEY TO THE VARIETIES OF O. LAGOPUS

1. Mature secondary leaves lanceolate in outline, with 9–17 leaflets well-distributed along a rachis several times longer than the longest leaflet................ 2

— Mature secondary leaves broadly oblong in outline, not much longer than broad, with 5–9 leaflets congested on a rachis 5–13 mm. long, about equalling the longest leaflet. Pod variable in length, either included in or exserted from the moderately inflated calyx which, ruptured or not, loosely invests and persists with the legume until dehiscence.. b. var. *conjugans*

2 Calyx early becoming inflated, somewhat accrescent, enclosing the short pod and deciduous with it before dehiscence.. a. var. *Lagopus*

— Calyx little or not at all inflated, ruptured by the exserted pod and persistent with it until dehiscence or after.. c. var. *atropurpurea*

11a. **Oxytropis Lagopus** Nutt. var. **Lagopus**

Oxytropis Lagopus Nutt., Jour. Acad. Philad., 7:17. 1834 (as "*lagopus*"). *Spiesia Lagopus* (Nutt.) O. Kze., Rev. Gen., 206. 1891. *Aragallus Lagopus* (Nutt.) Greene, Pittonia, 3:212. 1897. *Astragalus Lagopus* (Nutt.) Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937.

Aragallus Blankinshipii A. Nels., Erythea, 7:58. 1899, pro parte, emend. Rydb., Bull. Torr. Club, 34:422. 1907. *Oxytropis Blankinshipii* (A. Nels.) K. Schum., Just's Jahresb., 27^1:496. 1901. *Astragalus Blankinshipii* (A. Nels.) Tidestr., Proc. Biol. Soc. Wash., 50:18. 1937.

Habit of the species; scapes erect, arcuate-ascending or procumbent, 3–13 cm. long, either appressed-pilose, ascending-pilose, or villous-hirsute; racemes 6–18-flowered; calyx becoming turgid, in fruit accrescent, ovoid-urceolate and ventricose-inflated, 10–14 (18) mm. long, constricted at the mouth and enclosing the legume, not ruptured; pod commonly minutely stipitate, the ovoid body 6–10 mm. long, 4–5 mm. in diameter, passing into a short deltoid or lanceolate beak about equalling the connivent calyx-teeth; pedicels articulate with the axis in fruit, deciduous with the calyx and pod before dehiscence. *Type* collected by Nathaniel B. Wyeth, in 1833, about the sources of the Missouri; sources of the Missouri, *Wyeth* (PH, NY)!

Distribution: Sandy bluffs, grassy hillsides, and gravelly knolls, sometimes among sagebrush, altitude 4,200–7,000 ft., western Montana and east-central Idaho to Yellowstone Park and the upper Wind River, Wyoming. Map 5.

Representative collections: Idaho. Henry Lake, Fremont County, *E. & L. Payson 2028* (CAS, GH, NY). Montana. Monida, Beaverhead County, *A. & E. Nelson 5421* (GH, ND, NY, POM, WTC). Middle Creek, 15 mi. sw. of Bozeman, Gallatin County, *J. W. Blankinship in 1898* (GH, NY, in part, isotypes of *Aragallus Blankinshipii)*. N. of Big Timber, Sweet Grass County, *Ripley & Barneby 8069* (CAS, NY). Wyoming. N.-w. Wyoming (probably Yellowstone Park; cf. Jones, Rep. Reconn. NW. Wyo., 310, sub *O. Lambertii* var.), *Parry 91* (GH, NY). Dubois, Fremont County, *Ripley & Barneby 8913* (WYO).

The var. *Lagopus* is unmistakable in fruit, being the only species of its region, except for a rare form of var. *conjugans,* with inflated calyx. It is one of the earliest spring flowers, and by mid-June is commonly past anthesis, when the low silvery tufts, often surrounded by a ring of fallen calyces, become an inconspicuous feature of the hillside flora. Variation follows a pattern usual in the genus, dwarf and relatively giant phases being not uncommon. The scapes vary from erect to prostrate, and though most commonly appressed-pilose, they may on occasion be copiously hirsute or villous. The calyx-hairs vary greatly in color; the wing-petals may be either narrowly oblong or much dilated upward; and the pod and fruiting calyx fluctuate greatly in length and diameter. But these are trivial variations which occur independently of each other, and are without taxonomic significance.

The identity of the type of *O. Lagopus* cannot be made out beyond all chance of controversy from the immature and fragmentary type. Wyeth's plants are barely coming into flower, and the ultimate state of the calyx and pod can never be established. In the region traversed by Wyeth, "between the Falls of the Columbia and the first navigable waters of the

Missouri,''[4] two forms of *O. Lagopus* are now known, the rare var. *conjugans* and the much commoner phase which passes as *O. Blankinshipii*, the var. *Lagopus* of this paper. These differ at young anthesis principally in the number of leaflets. In the type, unfortunately, most of the leaves are incomplete, but one primary leaf (NY) has nine leaflets, as opposed to the usual five or seven in var. *conjugans*. Although the evidence is not conclusive, it seems most probable that Wyeth had the common var. *Lagopus*.

The application of the name *Lagopus* to a plant with exserted pod, current for many years, can be traced back to Gray's second revision of *Oxytropis* (1884). In his earlier study (1864) he had reduced *O. Lagopus* to a mixed and chimerical *O. uralensis* var. *pumila*, but the intervening decades had brought to light further material from Montana and Wyoming which enabled him to revive and redefine the species. Gray's *O. Lagopus* of 1884 was a mixture of the Montana plant with included pod *(Scribner 29a* from Bozeman. in flower only) i. e. var. *Lagopus*, and var. *atropurpurea (Parry 92; Greene* from Cheyenne) with exserted pod. He did possess fruiting material of var. *Lagopus* in the shape of *Parry 91* from Yellowstone, but this, probably because its scapes were, unlike the rest, appressed-pilose, he referred to *O. nana*, the pod of which was first, most erroneously, described from these specimens. Thus in 1884 Gray's *O. nana*, as to the fruit, was var. *Lagopus*, while his *O. Lagopus*, as to the fruit, was the Wyoming var. *atropurpurea*. These errors, natural at the time, still echo in the literature. Rydberg conceived *O. Lagopus* as having villous scapes and the pod somewhat exserted, thus including with most of var. *atropurpurea* (when lacking conspicuously black calyx) and the whole of var. *conjugans* a large element of var. *Lagopus* (when in flower). Simultaneously he was maintaining an *O. Blankinshipii*, supposedly with included pod and appressed-pilose scapes, and referring otherwise similar material with ascending scapes to *O. nana*, here following Gray's disposition of *Parry 91*. Aven Nelson, evidently baffled by the ambiguous treatments of *O. Lagopus* and *O. nana*, suggested (Univ. Wyo. Pub. Bot., 1: 118, 1926) that they were synonymous, as current concepts of them indeed were, in greater or less degree.

Oxytropis Blankinshipii has itself had a confused history. It was originally described by Nelson from fruit of *O. Lagopus* and flowers of *O. Besseyi*, as pointed out by Rydberg (1907, l. c.), who restricted the name to the fruiting element. On yet another mixture involving *O. Lagopus* Nelson founded his *Aragallus collinus*, the flowering (and as emended by Rydberg, typical) element being in this case a specimen of *O. nana*. The *Aragallus*

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[4] According to Blankinship (Mont. Agric. Sci. Stud., 1:6—1905), Wyeth entered Montana along Clark's Fork in April 1883, and after following this stream as far as Missoula, turned south up the Bitter Root, across into the Big Hole Basin, and thence over to the Salmon River in Idaho. It can be assumed, from their youthful condition, that the specimens of *O. Lagopus* were collected in early spring, certainly not later than May, and probably therefore in the Bitterroot or Big Hole valleys.

collinus of Rydberg's Flora of Montana corresponds however with the original fruiting character, and is thus pure var. *Lagopus.*

The specific epithet, both written and published by Nuttall as "*lagopus,*" was first capitalized by Torrey and Gray. The latter spelling seems more appropriate to a noun in apposition, and is probably best followed.

11b. **Oxytropis Lagopus** Nutt. var. **conjugans** Barneby, new variety

Oxytropis Lagopus Nutt. var. *conjugans*, var. nov., a prole typica necnon var. *atropurpurea* praesertim foliolis paucis secus rachin breviorem 3–13 mm. tantum longum confertis, ab eo etiam fructu diu persistenti absimilis. Legumen mediocre calyce adeo accrescenti nunc integro inclusum, nunc ventraliter fisso ad medium tantum usque suffultum.

Densely silky-lanuginous throughout, the scapes and petioles villous with fine horizontally patent hairs; leaves all short and congested on the crowns, broadly oblong, 0.7–4.5 cm. long, with 5–9 leaflets 5–13 mm. long crowded on a rachis about equalling the longest leaflet; racemes 5–9-flowered; scapes erect; calyx somewhat accrescent and inflated, either ruptured or not, entirely enclosing or but investing the lower half of the pod; body of the pod ovoid-oblong, 8–13 mm. long, about 5 mm. in diameter, passing upward into a short more or less divaricate beak; pedicels persistent with the calyx and fruit until dehiscence, not readily disarticulating. *Type:* Vicinity of Helena, Montana, June, 1921, *E. O. Wooton* in Herb. U. S. National Museum *No. 1086296;* isotype NY.

Distribution: Stony calcareous hilltops, at about 5,000 ft., in the valleys of the Missouri, Sun, and Teton rivers to the north and south of Helena, Montana, extending to the Pacific slope in the valleys of Clark's Fork and the Big Blackfoot River. Map 5.

Representative specimens: Montana. Helena, Lewis and Clark County, *Kelsey 229* (ND), *in 1886* (OB), *in 1888* (POM, UC, US). S.-e. of Helena, in Jefferson County, *Ripley & Barneby 8186.* Big Blackfoot River, *Pearsall 892* (NY). 15 mi. w. of Choteau, Teton County, *Hitchcock & Muhlick 18088* (RB).

The present variety resembles var. *atropurpurea* in the legume being persistent on the raceme until dehiscence. The calyx may be similar, little inflated and therefore ruptured, or at times strongly inflated and wholly enclosing the shorter pod, when the fruiting raceme resembles that of var. *Lagopus.* The broad short leaves with their few leaflets are distinctive. So far as known the scapes and petioles are always long-villous, and it is perhaps suggestive that the phase of var. *Lagopus* (with included and promptly deciduous pod) immediately contiguous in range shows an approach to this loose type of vesture. The var. *conjugans* seems neatly to fill the gap between var. *atropurpurea,* from which it is geographically disjunct, and var. *Lagopus* in whose range it seems to occupy a restricted island.

11c. **Oxytropis Lagopus** Nutt. var. **atropurpurea** (Rydb.) Barneby

Oxytropis Lagopus Nutt. var. *atropurpurea* (Rydb.), Barneby, Leafl. West. Bot., 5:111, 1951. *Aragallus atropurpureus* Rydb., Bull. Torr. Club, 34:424. 1907. *Oxytropis atropurpurea* (Rydb.) A. Nels., Univ. Wyo. Pub. Bot., 1:117. 1926.

Habit of var. *Lagopus,* but commonly more loosely pilose, the scapes and petioles as a rule copiously villous, sometimes thinly so or even appressed-pilose; calyx densely shaggy with light or dark hairs in varying proportions, little or not accrescent in fruit, ruptured by but closely investing the base of the exserted pod; body of the pod 8–15 mm. long, oblong or ovoid, turgid to decidedly inflated and 4.5–6.5 mm. in diameter, passing gradually or abruptly into a straight, divaricate, or even declined beak 4–5 mm. long; pedicels persistent at least until dehiscence. *Type* collected by Frank Tweedy, in 1898, on the headwaters of the Tongue River, Big Horn Mountains, Wyoming; *Tweedy 125, 126* (NY, cotypes)!

Distribution: Gravelly plains, knolls and open hillsides between 5,000 and 8,300 ft. altitude, nearly throughout Wyoming, from the Platte River drainage to the Big Horn Basin, adjacent southeastern Montana, and west to the head of the Green River. Map 5.

Representative specimens: MONTANA. Busby, Big Horn County, *Grinnell 45* (US). WYOMING. Sand Creek, Albany County, *A. Nelson 7039* (GH, NY, POM). Sour Dough Creek, Johnson County, *L. & R. Williams 3296* (GH, NY, WTC, WTU). N.-w. Wyoming, *Parry 92* (NY).

Like var. *Lagopus,* which it replaces at middle altitudes over most of Wyoming, var. *atropurpurea* varies considerably in stature, in the color of the calyx-hairs, in the orientation of the pubescence, and in the length and inflation of the pod. The cotypes of *A. atropurpureus* are especially robust and copiously villous, and the inflorescence is uncommonly dark, but we have approximate topotypes (Upper Tongue River, Sheridan County, *Ripley & Barneby 8021,* CAS, NY) in which the scapes may be sparingly villous, or with loose hairs almost lacking, and in which the proportion of dark hairs on bracts and calyces is quite variable. Some hairs of dark color are nearly always present, at least on the calyx-teeth, but they may be almost concealed by the longer pale villi which form the vesture characteristic of the species as a whole. The pod in the type emerges but little beyond the calyx-teeth, but it is found far exserted in otherwise similar plants. In one collection from South Pass, Fremont County, Wyoming *(Ripley & Barneby 7955,* CAS) the legume varies extraordinarily in outline, in some racemes being broadly and obliquely ovoid with sharply declined beak, in others oblong-ellipsoid and abruptly contracted into a nearly erect beak.

Material of var. *atropurpurea* has commonly been referred to *O. Lagopus* proper, and formed the basis of Gray's concept of the species, as also, in great part, that of Rydberg, Nelson, and others. In early years Nelson distributed several collections from near Laramie as *O. monticola,* but most subsequent ones were labelled *O. Lagopus. Aragallus atropurpureus,* at first reduced by Coulter and Nelson (New Man. 295, 1909) to *O. Lambertii,* was at length revived and transferred by Nelson to *Oxytropis.* No reason was then given for distinguishing it from *O. Lagopus* sensu Nelson, with which it is surely conspecific.

12. **Oxytropis Besseyi** (Rydb.) Blank.

Cespitose, with several to many crowns clustered on the summit of a pluricipital taproot, the short caudex-branches clothed with a thatch of persistent stipules and petioles; pubescence silky-pilose, loosely appressed except on the villous pod and the often spreading-hirsute calyx; stipules membranous, pale or sometimes herbaceous in youth, becoming chartaceous in age, 6–14 mm. long, more or less silky-pilose dorsally, the free blades narrowly to broadly deltoid, 1.5–5 mm. long, ciliate; leaves 1.5–12 cm. long, little dimorphic, the slender petioles 0.5–6 cm. long, appressed-pilose and often bearing some looser, ascending hairs; leaflets 5–21, approximate or discrete, narrowly elliptic, lanceolate or rarely lance-ovate, 4–21 mm. long, 1–4 mm. wide, flat or involute, equally pilose on both faces; scapes erect or ascending, rarely sigmoid-arcuate, 2–19 cm. long, often with a few ascending as well as appressed hairs; racemes 3–20-flowered, capitately subumbellate or loosely racemose at full anthesis, little or not at all elongating thereafter; bracts ovate-rhombic to lanceolate or lance-acuminate, 5–14 mm. long, 2–4.5 mm. broad near the base (where pallid, obscurely carinate and cucullate), flat and herbaceous above, silky-pilose dorsally and ciliate; calyx 9–13 mm. long, the cylindro-campanulate, membranous, purplish or ultimately stramineous tube 6–8 mm., the herbaceous, deltoid to lance-subulate teeth 3–6 mm. long; petals brilliant pink-purple, drying bluish, with a white, striate lozenge in the banner; banner 17.5–25 mm. long, expanded above the broad claw into an ovate-oblong or somewhat fiddle-shaped blade 6–8 mm. wide; wings 14.5–25 mm. long, the asymmetric blades 9–15 mm. long, obliquely dilated and 4.5–7 mm. wide near the emarginate apex; keel 12.5–18 mm. long, the blades 6–8.5 mm. long including the straight or arcuate appendage (0.3–2 mm.); pod splitting the calyx when fully formed but commonly invested by it, erect or spreading, shortly but manifestly stipitate, the stipe up to 1.2 mm. long and more less obliquely attached, the body 10–14 mm. long, variably inflated or turgid and 2.5–10 mm. in diameter, somewhat obcompressed and passing into a lanceolate more or less divaricate beak about 5 mm. long, the ripe valves chartaceous, scarcely rigid, villous with pale shining hairs 1.5–3 mm. long, the ventral suture produced inward as a flange 0.8–2 mm. wide, either traversing the chamber or, when the pod is much inflated, forming only a partial and incomplete septum; seeds brown, sometimes speckled with purple, 1.8–2.3 mm. in diameter.

Like most of our species, *O. Besseyi* displays extremes of nanism and gigantism. While the corolla, the proportions of the calyx and the vesture of the herbage remain constant within comprehensible limits, the plants show marked diversity in length of raceme, in number and size of leaflets, and in the incidence of long spreading hairs on the calyx. On the basis of these characters it is possible to make out five varieties, to some small extent intergradient, but with satisfactory individual areas of dispersal.

Key to the Varieties of O. Besseyi

1. Calyx thinly hispid-hirsute, the hairs mostly widely spreading, about 2 mm. long 2

— Calyx appressed-silky, if with some loose hairs then these ascending at a narrow angle and shorter 4

2. Racemes loose, 2–8 cm. long at full anthesis, on scapes 9–19 cm. long; leaflets 9–21, scattered on a rachis 2–9 cm. long. N.–e. Wyoming, in the drainage of Cheyenne and Powder rivers, n. to the Missouri in Montana, thence s.–w. to the Madison River and Yellowstone Park .... a. var. *Besseyi*

— Racemes dense, subcapitate, 0.5–2 cm. long at full anthesis, on scapes 2–9 (12) cm. long; leaflets 5–9 (11), crowded on a rachis 3–14 mm. long 3

3. Leaflets of developed leaves 9–20 mm. long; Wyoming in the drainage of Green, Platte, and Wind rivers .... b. var. *ventosa*

— Leaflets of developed leaves 3–10 (13) mm. long; s.–w. and extreme w. Montana to adjacent Idaho .... c. var. *argophylla*

4. Leaflets 5–9; racemes 7–10-flowered, subcapitate at anthesis, the axis becoming 1–2 (2.5) cm. long in fruit: Custer County, Idaho .... d. var *salmonensis*

— Leaflets 7–15; racemes 11–19-flowered, looser, the axis becoming 2.5–5.5 cm. long in fruit; Big Horn Basin, Wyoming .... e. var *fallax*

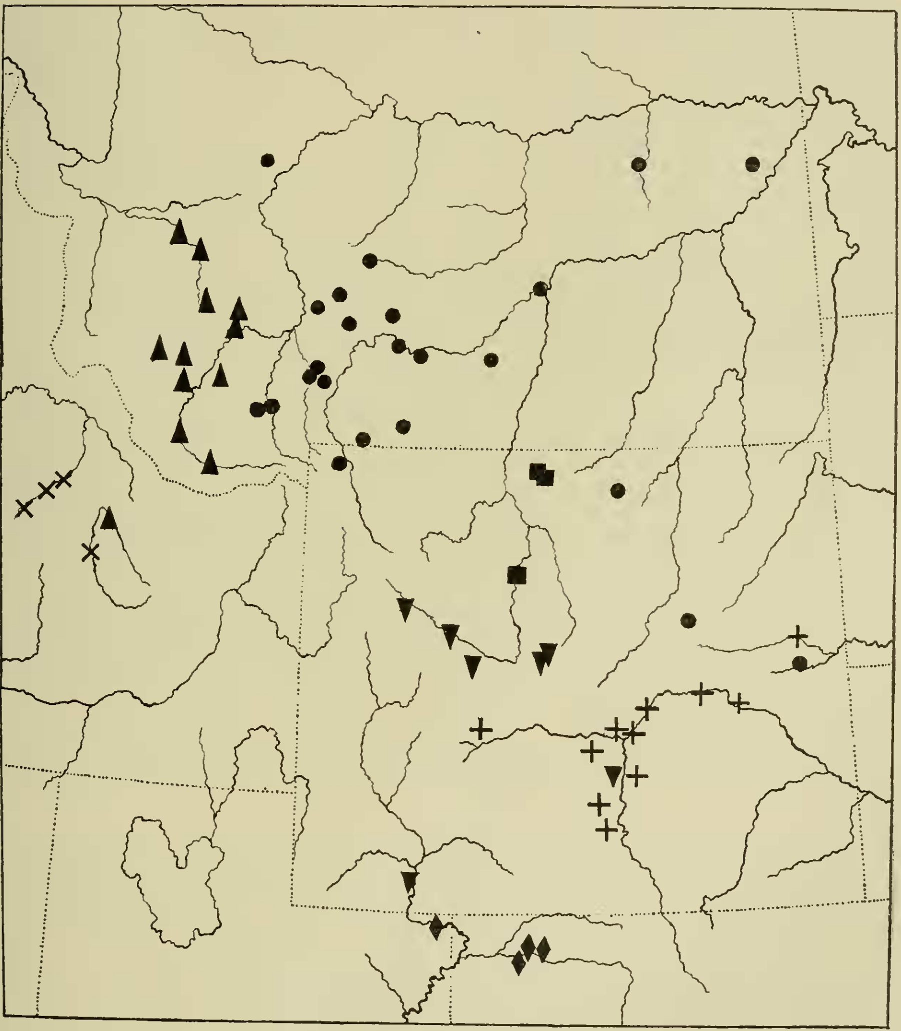
12a. **Oxytropis Besseyi** (Rydb.) Blank. var. **Besseyi**

Oxytropis Besseyi (Rydb.) Blank., Mont. Agric. Coll. Sci. Stud., Bot. 1:80. 1904; Dayton, Proc. Biol. Soc. Wash., 40:120. 1927 (as "comb. nov."). *Aragallus Besseyi* Rydb., Mem. N. Y. Bot. Gard., 1:250. 1900.

Commonly robust, the leaves 3–12 cm., the erect scapes 9–19 cm. long; leaflets (except in dwarfed or immature individuals) 9–19, scattered along a rachis much longer than the longest leaflet; racemes 7–20-flowered, oblong at anthesis, the axis 2–8 cm. long in fruit; calyx 9–13 mm. long, hispid-hirsute with long, shining hairs, the tube 6–7 mm., the teeth 3–6 mm. long; banner 18–25 mm. long; pod scarcely to considerably inflated, the body 8–14 mm. long, 2.5–5 mm. in diameter. *Type* collected by P. A. Rydberg and

Ernst A. Bessey, in 1897, at Spanish Basin, Madison County, Montana; *Rydberg & Bessey 4501* (NY, GH, ND, US)!

Distribution: Gravelly hilltops, river-bluffs, and sandy banks; widespread in Montana east of the Continental Divide, but especially abundant along the upper branches of the Missouri and Yellowstone rivers, to Yellowstone Park, and southward to the upper Powder and Cheyenne rivers in east-central Wyoming. Map 6.



Map 6. Ranges of *Oxytropis Besseyi:* var. *Besseyi* ●; var. *ventosa* ▼; var. *argophylla* ▲; var. *salmonensis* X; var. *fallax* ■; of *O. obnapiformis* ◆; and of *O. nana* +.

Representative specimens: MONTANA. "Banks of Clarck's River," *M. Lewis* (PH)[5]. Middle Creek, 15 mi. s.-w. of Bozeman, *Blankinship in 1898* (GH, NY, the collection from which the flower of *Aragallus Blankinshipii* was described; cf. infra). E. of Columbus, Stillwater County, *Ripley & Barneby 8056* (CAS, US). Custer, Yellowstone County, *Blankinship 152* (GH, NY, OB). WYOMING. Salt Creek Road, Natrona County, *Goodding 225* (GH, NY, POM). Yellowstone Park, *Rev. Chas Hall in 1888* (NY).

The typical variety of *O. Besseyi* is the handsome and robust Loco common on bluffs along the upper tributaries of the Missouri and the Yellowstone. It has been likened to *O. Lambertii,* with which it is occasionally associated, but the hispid-villous calyx, the thin-walled, villous pod, and the basifixed pubescence are distinctive. The calyx is apparently always broken eventually by the legume, but at maturity the pedicels are often insecurely attached to the axis of the raceme, so that calyx and pod tend to be deciduous together. But to the northeast, in somewhat more arid climate, plants occur in which the pod persists over winter on marcescent peduncles. The pod itself is variable in length, in degree of inflation, and in the width of the partition. When the partition is narrow and the valves strongly distended, the pod is almost wholly unilocular. At the other extreme a broad septum in a narrow pod produces a semibilocular or nearly bilocular condition. Intermediate states are found in otherwise like plants, and the depth of the partition has no taxonomic significance.

In western Montana var. *Besseyi* and *O. Lagopus* occur together, the former coming into flower in June when the other is already, at the same altitude, in advanced fruit. A mixture of the two collected by Blankinship near Bozeman became the basis of *Aragallus Blankinshipii* A. Nels. The diverse elements were early analyzed by Rydberg (Bull. Torr. Club, 34: 422, 1907) who, rejecting Blankinship's statement (Mont. Agric. Coll. Sci. Stud., Bot., 1: 80, 1904) that the mature plant with inflated calyx was infected by uredo, certainly untrue of the material seen by the writer, restricted the epithet *Blankinshipii* to the fruiting plant. It thus became a synonym of *O. Lagopus.*

According to Blankinship and Henshall, the species is known in Montana as "Red Loco" or "shoestrings."

12b. **Oxytropis Besseyi** (Rydb.) Blank. var. **ventosa** (Greene) Barneby

Oxytropis Besseyi (Rydb.) Blank. var. *ventosa,* Barneby, Leafl. West. Bot., 5:111. 1951. *Aragallus ventosus* Greene, Proc. Biol. Soc. Wash., 18:15. 1905.

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[5] This is the plant listed by Pursh, Fl. Amer. Sept. 473—1814, as *O. argentata* (not, however, of DC.), and according to Coues (Proc. Philad. Acad. 1898, p. 298—1899), who made a special study of Lewis and Clark's route, it must have been collected on July 1–2 in the Bitterroot valley at the mouth of its Lou-Lou branch, in the present Missoula County, Montana. This statement is difficult to reconcile with our knowledge of the range of *O. Besseyi* var. *Besseyi,* to which Lewis's plant unquestionably belongs. July, the month given also on the label, is late in the season for young flowering material of this species at an altitude not much exceeding 3,000 feet, and there may be some error in the original data.

Similar to var. *Besseyi,* but reduced; leaves 3–7 cm. long, with 5–7, rarely 9 flat leaflets (8) 10–21 mm. long, congested on a rachis 5–14 mm. long, usually shorter than the longest leaflet; racemes subcapitate at anthesis, remaining so in fruit, or the axis becoming up to 1.5 (2) cm. long; calyx 9–10.5 mm. long, the teeth 3–4 mm. long, the vesture as in var. *Besseyi;* banner 15–20 mm. long; mature pod not seen, but when young exactly as in var. *Besseyi. Type* collected by W. H. Forwood, in 1884, on dry ground in the valley of the North Fork of Wind River, Wyoming; *Forwood 65* (US, type, GH)!

Distribution: Arid stony hilltops, sandy banks, or cobblestone bluffs in the drainage of the Wind, Platte, and Green rivers of central and southern Wyoming. Map 6.

Representative specimens: Wyoming. Bird's Eye, Fremont County, *A. Nelson 9343* (GH, NY, POM, US, WTU). N.-w. Wyoming (i. e. Wind River, acc. Parry in Jones, Rep. Reconn. N.-W. Wyo., 310), *Parry 90* (GH), 29 mi. s. of Green River, *Ripley & Barneby 7896* (CAS).

The var. *ventosa,* maintained on slender characters, is obviously a minor entity, but it is readily recognizable and has a natural range to the southwest of its more robust counterpart, var. *Besseyi.* In stature it is intermediate between var. *Besseyi* and var. *argophylla,* in facies more like the latter, from which it is geographically disjunct.

The rather few known collections have been very differently disposed of in the past. Both the type and *Parry 90* were referred by Gray to his mixed "*O. nana.*" Nelson distributed several gatherings under an unpublished epithet "*coeruleus,*" but subsequently removed these (Univ. Wyo. Pub. Bot., 1: 113, 1926) to his "*O. sericea,*" a curious mixture of var. *ventosa* and *O. Lambertii* var. *Bigelovii* which has nothing whatever in common with the original *O. sericea* Nutt.

12c. **Oxytropis Besseyi** (Rydb.) Blank. var. **argophylla** (Rydb.) Barneby

Oxytropis Besseyi (Rydb.) Blank. var. *argophylla* Barneby, Leafl. West. Bot., 5:111. 1951 (Jan.); R. J. Davis, Madroño, 11:144. 1951 (Jul.). *Aragallus argophyllus* Rydb., Mem. N. Y. Bot. Gard., 1:255. 1900.

Dwarf and densely cespitose, the herbage silvery-white; leaves 1.5–4 cm. long, with 5–9, rarely 11, often involute leaflets 3–10 (13) mm. long, crowded on a rachis mostly shorter than the longest leaflet; scapes 2–7 (9) cm. long, erect, ascending or sigmoid-arcuate; racemes subcapitately 3–10-flowered, the axis 0.5–1.5 cm. long in fruit; calyx 9–10.5 mm. long, the teeth 3–4.5 mm. long, the vesture as in var. *Besseyi;* banner 17.5–21 mm. long; pod evidently inflated, 4–6 mm. in diameter. *Type* collected by J. G. Cooper, in 1860, on the "Little Blackfeet River, Montana"; *Cooper in 1860* (NY, type; GH, fragments)!

Distribution: Stony hilltops and river-bluffs, common about Butte, Montana, extending northwestward along Deer Lodge Valley and south into Beaverhead County and adjacent Idaho. Map 6.

Representative specimens: IDAHO. Head of Mahogany Creek, Lost River Mts., Custer County, *Hitchcock & Muhlick 11024* (CAS, NY, WTC, WTU). MONTANA. Armstead, Beaverhead County, *E. & L. Payson 1911* (CAS, GH, NY). Anaconda, Deer Lodge County, *Blankinship 769* (US). 7 mi. n. of Deer Lodge, Powell County, *Ripley & Barneby 8161* (CAS).

This dwarf *Oxytropis,* quite similar to var. *Besseyi* in flower and pod, but much diminished in stature, with few congested leaflets and capitate racemes, abruptly replaces the typical form of the species to the west of the Continental Divide. It is a minor but readily distinguished geographic entity.

The variety has often passed as *O. nana,* the early collections having been referred there in Gray's two revisions of the genus. These were in flower only and do superficially resemble the type of *O. nana,* but the calyx-teeth are longer, the vesture of the calyx is quite different, and the fruit is now known to be well exserted, at length becoming turgid and splitting the calyx.

12d. **Oxytropis Besseyi** (Rydb.) Blank. var. **salmonensis** Barneby

Oxytropis Besseyi (Rydb.) Blank. var. *salmonensis,* var. nov., foliolis paucis (5–9) adeo approximatis var. *argophyllae* atque var. *ventosae* (ut supra descriptis) habitu adspectuque similis, sed calyce subappresse sericeo nec pilis patulis hirsuto, et legumine maxime inflato subgloboso aberrans.

Similar to vars. b. and c., low and tufted; herbage appressed-silky throughout; leaves 4–8 cm. long; leaflets 5–9, rather crowded, 10–19 mm. long, the rachis 6–20 mm. long; scapes surpassing the leaves, racemes 7–10-flowered, subcapitate at early anthesis, the axis becoming 1–2 (2.5) cm. long in fruit; calyx silky with appressed and a few looser but closely ascending hairs, not spreading-hirsute, the tube 7–8 mm., the teeth about 3 mm. long; pod strongly inflated, the body subglobose. *Type:* Salmon River Canyon, 12 miles below Clayton, Custer County, Idaho, alt. 5,400 ft., 22 June 1947, *Ripley & Barneby 8829,* in Herb. Calif. Acad. Sci. *No. 338976;* isotypes NY, IDS.

Distribution: Friable clay declivities along the Salmon and Big Lost rivers in Custer County, Idaho. Map 6.

Specimens examined: IDAHO. Mackay, Custer County, *Nelson & Macbride 1567* (CH). Spar Canyon, 20 mi. e. of Clayton, *C. L. Hitchcock 15669* (RB). Below Clayton, *R. J. Davis 448* (IDS). 13 mi. sw. of Challis, *J. & C. Christ 17739* (RB).

The variety *salmonensis* is found in some quantity on soft, shaley clay banks of lateral canyons leading into the gorge of the Salmon River, where it is associated with *Thelypodium repandum* Roll. and *Astragalus amblytropis* Barneby, both close endemics recently described, and it seems to be a definite and isolated type, even though not distinguished from the rest of its species by very substantial characters. In habit it resembles var. *ventosa* and var. *argophylla,* the former especially in stature, but differs from both in the absence of long hirsute trichomes on the calyx, so characteristic of *O. Besseyi* as a whole (with the exception of var. *fallax* below), and in the strongly inflated legume. This inflation is so pronounced that Nelson identified his gathering from Mackay as *Aragallus inflatus (O. podocarpa),* a distantly related species known in the Rocky Mountains only from above timberline.

12e. **Oxytropis Besseyi** (Rydb.) Blank. var. **fallax** Barneby

Oxytropis Besseyi (Rydb.) Blank. var. *fallax,* var. nov., statura adspectuque var. *Besseyi* persimilis, et ab ea calycis subappresse sericei (nec pilis divaricatis hirsuti) dentibus paullo brevioribus 2–2.5 mm. longis necnon legumine saepissime magis inflato tantum separanda. Ab *O. obnapiformi* (leguminis forma nostram simulanti) pube, foliolis minus numerosis et praesertim legumine stipitato longius villoso abhorret. *O. obnapiformis* C. L. Porter, Madroño 9:133. 1947, pro minori parte.

Similar to var. *Besseyi;* leaflets 7–15, not closely set along the rachis, 10–22 mm. long; scapes surpassing the leaves; racemes 11–19-flowered, somewhat elongate in fruit, the axis becoming 2.5–5.5 cm. long; calyx silky-pilose with appressed or a few looser but strictly ascending hairs, not spreading-hirsute, the tube 6.5–8 mm., the teeth 2–2.5 mm. long; keel about 15 mm. long; pod turgid to strongly inflated, the body ovoid to oblong-ovoid, 7–13 mm. long, 4.5–7 mm. in diameter, abruptly passing into the laterally compressed beak; seeds 2.3–3 mm. long, sometimes faintly mottled. *Type:* mouth of Shell Creek, Big Horn Mountains, Big Horn County, Wyoming, alt. 4,350 ft., 16 June 1946, *Ripley & Barneby 8010,* in Herb. Calif. Acad. Sci. *No. 343211;* isotypes GH, US, WYO.

Distribution: Sandy clay slopes and barren hilltops, mostly on sandstone, in the western foothills of the Big Horn Mountains, west to the Big Horn River, Wyoming. Map 6.

Specimens examined: WYOMING. Five Springs Falls, Big Horn County, *L. & R. Williams 3314* (NY, WTC). 2 mi. s. of Kirby, Hot Springs County, *Ripley & Barneby 8001* (CAS).

The collections on which the present variety is based have given rise to some confusion. The two gatherings from Big Horn County are alike in their strongly inflated, obliquely ovoid pods, and were referred by Porter to *O. obnapiformis,* from which the developed stipe of the fruit, the type of pubescence, and other characters of less moment (cf. discussion of *O. obnapi-*

formis, below) separate them. On the other hand they are ultimately distinguished from typical *O. Besseyi* only by the lack of hispid hairs on the calyx, a character which recurs in *O. Besseyi* var. *salmonensis,* by the slightly shorter calyx-teeth, and by the more pronounced inflation of the pod-valves. The last character is invalidated, however, by the plant from Kirby, cited above, in which, although the calycine peculiarities remain, the pod is no more turgid than in the common state of var. *Besseyi.* The var. *fallax* stands in the same relationship to var. *Besseyi* as does var. *salmonensis* to var. *ventosa,* a small but apparently established race of the pleiomorphic *O. Besseyi* representing the species in the Big Horn Basin.

13. **Oxytropis obnapiformis** C. L. Porter

Oxytropis obnapiformis C. L. Porter, Madroño 9:133, fig. 1, 1947, pro max. parte.

Densely cespitose, with a stout taproot and multicipital caudex, the full-grown tufts composed of upward of 50 crowns; herbage densely white, silky-pilose, and, especially when young, subtomentose with fine flexuous basifixed hairs; stipules membranous, becoming chartaceous and persistent, ovate, 12–20 mm. long, at first shortly connate opposite the petiole but early ruptured, the free blades broadly deltoid-acuminate, 4–7 mm. long, the whole densely and permanently pilose-tomentose, the margins copiously ciliate; leaves 6–20 cm. long, the firm, basally long-persistent petiole and rachis silky-tomentose and ascending-pilose with some longer hairs; leaflets (7) 13–25, often distant and somewhat scattered, lanceolate or lance-oblong to oblong-elliptic, obtuse or acutish, 6–18 mm. long, commonly conduplicate and falcate, rarely becoming greenish in age; scapes erect and ascending, 6–13 cm. long, surpassed by the leaves; racemes 8–22-flowered, dense at first anthesis, becoming looser, the fruiting axis 2.5–8 cm. long; bracts lanceolate, somewhat involute at base, 5–8 mm. long, densely silky-pilose dorsally; calyx 10–11 (13) mm. long, silky with subappressed pale hairs, the deeply campanulate submembranous tube 7.5–8 (9.5) mm., the broadly lanceolate herbaceous teeth 2.5–3 (4) mm. long; petals brilliant pink-purple with a pale striate eye in the banner; banner 18–21 (25) mm. long, the blade oblong, somewhat fiddle-shaped, shallowly emarginate, 9–10 mm. wide; wings 16–20 mm. long, the blades obliquely dilated upward, 5–5.5 mm. broad near the obliquely truncate or emarginate apex; keel 14.5–17 mm. long, the blades, including the straight appendage, 8–10 mm. long; pod sessile, strongly inflated, the body ovoid to subglobose, 5–8 mm. in diameter, gently obcompressed and sulcate ventrally, abruptly narrowed above into a deltoid-acuminate, laterally compressed, straight or slightly declined beak 4–8 mm. long, the valves chartaceous, stramineous when mature, densely gray-villous with ascending hairs about 1 mm. long, produced inward along the ventral suture as a flange 1.8–2 mm. wide; seeds olive-brown, 1.8–2 mm. in diameter.

Type collected by C. L. Porter, in 1946, 8–9 miles west of Maybell . . . Moffat County, Colorado; *C. L. Porter 3864* (RB, isotype)![6]

Distribution: Sandhills and sandy bluffs between 5,900 and 6,400 feet altitude along the Yampa and Green rivers in northwestern Colorado and adjacent Utah. Map. 6.

Specimens examined: UTAH. Sheep Creek Canyon, Daggett County, *L. O. Williams 9159* (GH, NY). COLORADO (all Moffat County). 4 mi. e. of Maybell, *Ripley & Barneby 9155* (CAS, GH, NY, POM, US, WTU, WYO). W. of Sunbeam, *Ripley & Barneby 9156* (CAS, WYO). S. of Lay, *Ripley & Barneby 9159* (CAS, NY, WYO).

Oxytropis obnapiformis is evidently related to *O. Besseyi,* finding a close resemblance, on account of the inflated pod, in *O. Besseyi* var. *fallax,* material of which was referred to it in the original description. The principal points of difference may be summarized. The vesture of *O. obnapiformis* is composed of finer and mostly shorter hairs, the scapes and young herbage thus becoming subtomentose rather than appressed-pilose, a quality difficult to describe or define, but striking in the field. The leaflets are decidedly more numerous, in developed leaves 13–25 as opposed to 7–13 in var. *fallax.* The scapes are prominently shorter than the leaves, so that the fruiting racemes scarcely emerge from the tufted foliage. The spreading hairs on the pod are only about half as long; while the pod itself is perfectly sessile on the receptacle, and lacks the stipe so evident in forms of *O. Besseyi* with similarly inflated pod and subappressed-pubescent calyx. The seeds of *O. obnapiformis* are appreciably smaller.

In sum, these are not strong characters, and perhaps of no more than subspecific value, especially so since typical *O. Besseyi* may have a subsessile pod and as many as 21 leaflets (but the pod then no more than turgid and the calyx hispid-pilose). Nonetheless the geographic isolation of *O. obnapiformis,* once the var. *fallax* element from the Big Horn Mountains is shifted to *O. Besseyi,* is impressive, and the species is probably best left to stand as such.

The Williams collection from Utah is in flower only, and hence determined with some doubt. The pubescence is that of *O. obnapiformis,* but the flower is more ample, with banner up to 25 mm. long, larger than anything yet known from Colorado. However the keel of the same corolla is 15 mm. long, within the observed limits of true *O. obnapiformis,* and the long banner is probably not important. One plant of this same collection is remarkable in having bracteolate calyces, a monstrous, or at least anomalous occurrence in *Oxytropis.* One further specimen doubtfully referred here is similar to the last, and likewise in flower only. It is mounted on a sheet labelled "Laramie Hills, *B. C. Buffum 41*" (NY) along with a small plant of *O. Lagopus* var. *atropurpurea.* The latter is not uncommon in the neighborhood of Laramie, and the label probably belongs with it alone. The origin of the other remains uncertain.

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[6] The type is at WYO, and numerous isotypes have been distributed to the leading American Herbaria; cf. Porter, l. c.

14. **Oxytropis viscida** Nutt.

Acaulescent, the leaves and scapes clustered on the pluricipital root-crown, or on the divisions of a forking caudex; stipules membranous, pale, connate at first but early ruptured, 6–20 (26) mm. long, densely pilose to glabrate dorsally, the margins ciliate, the deltoid to caudate-acuminate free blades 3–10 (15) mm. long; leaves 2–23 cm. long, the primary shorter than the rest, the petioles and rachis copiously to thinly villous, sparingly appressed-pilose, or glabrate; leaflets 19–39 or rarely more, diminishing upward, subopposite or rarely geminate and pseudo-verticillate, closely approximate or distant, ovate, oblong-lanceolate, acute or obtuse, 1.5–17 (22) mm. long, 1–5 (6) mm. broad, glabrate or glabrous on one or both (particularly the lower) surfaces, glandular and often verrucose (but the warts obscure or lacking in some dried material); scapes strict or ascending, stout or slender, 2.5–25 cm. long, copiously white-villous throughout, or only above, or nearly glabrous save for short, light or dark, pilosulous hairs below the raceme, smooth or verrucose; raceme 3–20-flowered, becoming 0.5–12 cm. long in fruit; bracts lanceolate to lance-ovate, obtuse or acute, 4–13 (20) mm. long, nearly always glabrous dorsally, exceptionally bearing a few scattered pale or fuscous hairs near the ciliate margins, viscid and often verrucose; calyx densely to thinly pilose with long pale loosely appressed or spreading hairs, or with shorter subappressed dark hairs, or with an admixture of both sorts, or the teeth and exceptionally the tube also nearly glabrous, the tube 4–7 mm., the teeth 1–4 (9) mm. long, the lower linear-subulate, the upper sometimes shorter and broader, all commonly glandular-verrucose; petals white, ochroleucous, (the keel purple-maculate or not) or reddish purple (drying bluish), the banner 11.5–19 mm. long, 4–6 mm. wide; wings 10–14 mm. long, the blades oblong to obliquely triangular, 6.5–9 mm. long, variably dilated upward and 2–5 mm. wide near the truncate or emarginate apex; keel 8–11 mm. long, the appendage minute or up to 1 mm. long; pod erect, sessile, ovoid to lance-ovoid or oblong, more or less tumid, the body (6) 8–12 (15) mm. long, (3) 4–5 mm. in diameter, passing abruptly or gradually into a conical to acuminate, erect or divaricate beak 2–7 mm. long, the valves membrano-chartaceous, strigulose to thinly short-pilosulous with pale, dark or mixed hairs, commonly verrucose, semi-bilocular to subbilocular, the septum 0.5–1.5 mm. broad; seeds brown or black, dull, 1.5–1.8 mm. in diameter.

The species of § *Gloeocephala* Bge., represented in America by *O. viscida* and its varieties, are closely interrelated, and a study of our forms cannot be more than exploratory until the nature and degree of variation in their

European and Asiatic relatives becomes established. Material for this purpose has not been available, but it may be noted that the characters in the leaflets, corolla, ovules, and pod employed by Bunge, and more lately by Vassilczenko and Fedtschenko in Flora U. R. S. S., to differentiate between *O. foetida* DC., *O. leucantha* (Pall.) DC., *O. Trautvetteri* Meinsh. and *O. anadyrensis* Vass. are unlikely to hold up under scrutiny if those species are as variable as their American relative. It is suspected, moreover, that one or more members of § *Polyadena* Bge., set off only by the presence of geminate leaflets, a phenomenon which crops up occasionally in *O. viscida,* may have to be considered as a further aspect of the wider problem.

In our territory *O. viscida* is unique by reason of its viscid herbage and inflorescence, which commonly exhale a pleasant resinous fragrance when fresh. The glandular quality sometimes becomes obscure in dried specimens, but a few glandular warts are nearly always to be found on the axis of the raceme, the calyx-teeth, or the pod. Failing these, the glabrous or nearly glabrous bracts provide a convenient and almost infallible character. The species is highly variable in stature, vesture, color of the petals, and other ways but the forms run together in such bewildering fashion that no firm basis has yet been found for maintaining as species the several currently accepted segregates. Three main geographic races, each embracing a number of minutely distinguishable populations, can be made out, but even these are linked by intergradient individuals.

KEY TO THE VARIETIES OF O. VISCIDA

1. Petals relatively narrow, the blades of the wings little dilated upward, 2–3 mm. wide at apex or, if up to 4 mm. wide, then the raceme becoming oblong and loose in fruit; leaflets usually numerous, 25 or more in the secondary leaves or, if less, then the calyx-teeth less than 2 mm. long........ 2

— Petals ample, the blades of the wings dilated upward and 3.5–5 mm. wide at apex; raceme nearly always subcapitate, the axis 1–2 (2.5) cm. long in fruit; leaflets rarely exceeding 25 in number. Alaska (and Siberia)........ c. var. *subsucculenta*

2. Scapes (except in depauperate individuals) 6–25 cm. long, if less than 8 cm. long then the calyx-teeth 2 mm. long or more and prominently verrucose. Alaska to California, Colorado, Minnesota and Quebec (Gaspé)........ a. var. *viscida*

— Scapes 2–8 cm. long; calyx-teeth 1–1.5 (rarely 2) mm. long. Arctic and subarctic, Mackenzie to Hudson Bay........ b. var. *hudsonica*

14a. **Oxytropis viscida** Nutt. var. **viscida**

Oxytropis viscida Nutt. ex T. & G., Fl. N. Amer., 1:341. 1838. *O. campestris* (L.) DC. var. *viscida* (Nutt.) Wats., Bot. King, 55. 1871. *Spiesia viscida* (Nutt.) O. Kze., Rev. Gen., 206. 1891. *Aragallus viscidus* (Nutt.) Greene, Pittonia, 3:211. 1897. *Astragalus viscidus* (Nutt.) Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937.

Oxytropis mollis Nutt. ex Gray, Proc. Amer. Acad., 6:235. 1864, in syn.

Aragallus viscidulus Rydb., Mem. N. Y. Bot. Gard., 1:253. 1900. *Oxytropis viscidula* (Rydb.) Tidestr., Cont. U. S. Nat. Herb., 25:332. 1925.

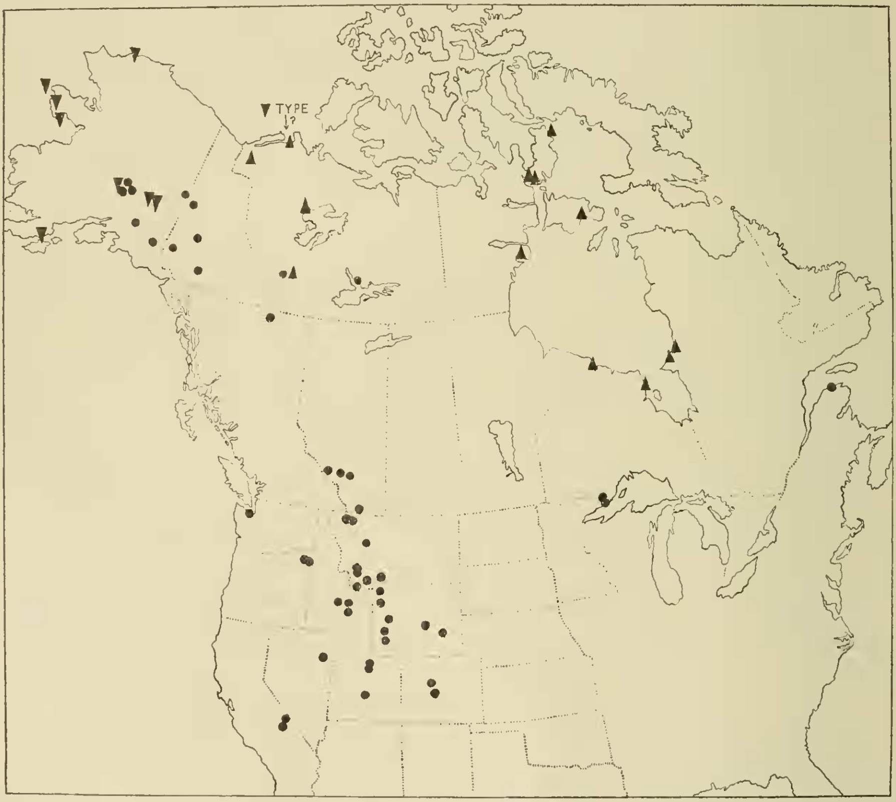
Aragallus viscidulus var. *depressus*[7] Rydb., Mem. N. Y. Bot. Gard., 1:523. 1900.

Oxytropis gaspensis Fern. & Kels., Rhodora, 30:123. 1928. *Astragalus gaspensis* (Fern. & Kels.) Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937 (non *A. gaspensis* Rouss., 1933).

Oxytropis ixodes Butters & Abbe, Rhodora, 45:2. 1943.

Oxytropis ixodes fma. *ecaudata* Butters & Abbe, op. cit., 4. 1943.

As described for the species, but the longest leaves rarely less than 8 cm. or the scapes less than 6 cm. long; leaflets commonly scattered, rarely geminate in some of the leaves, (19) 25–39 or more; racemes usually narrow, the axis (1) 2–7 cm. long in fruit; calyx-teeth 1.5–3.5 (4.5) mm. long, permanently and prominently verrucose, as also the pod and often the



Map 7. Range of *Oxytropis viscida:* var. *viscida* ●; var. *hudsonica* (in Mackenzie largely after Porsild and Raup) ▲; and var. *subsucculenta* (in America) ▼.

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[7] This name was written as a straight trinomial, without indication of category; but in the preface to the volume (p. xi) Rydberg referred to "varieties."

herbage; corolla whitish with concolorous or maculate keel, lilac or bright purple, the petals narrow, the wings 2–3 (4) mm. wide at apex. *Type* collected by Thomas Nuttall, in 1834, in the Rocky Mountains, near the sources of the Oregon, i. e. southwestern Wyoming; "R. Mts., Oregon," *Nuttall* (NY, PH)!; "R. Mts." *Nuttall* (GH, as *"O. mollis")!*

Distribution: Alpine crests, talus slopes, or dry hillsides, in the Rocky Mountains either above or below timberline, sometimes among sagebrush or in meadows, Alaska to Colorado, Washington (Olympic Mts.) and transmontane California (s. Sierra Nevada), with outlying stations on the Minnesota-Ontario border, and on Gaspé Peninsula, Quebec. Map 7.

Representative specimens: ALASKA. Teklanika Valley flats, *A. & R. Nelson 3582* (GH, NY, US, WTC, WTU). BRITISH COLUMBIA. Upper Liard River, *Dawson 2* (GH). ALBERTA. Basin, *Stewardson Brown 41* (GH, NY). ONTARIO. Thunder Bay District, *Butters, Abbe & Burns 682* (MINN, type of *O. ixodes* fma. *ecaudata,* GH). QUEBEC. Mont St. Pierre, Gaspé County, *Fernald & Smith 25874* (GH, type of *O. gaspensis,* CAS, NY), *Fernald & Weatherby* in *Pl. Gray. Exsicc. No. 560.* WASHINGTON. Mt. Angeles, Clallam County, *J. W. Thompson 8399* (CAS, NY, US, WTU). OREGON. Wallowa River, Wallowa County, *Cusick 2320* (GH, ND, WTC). IDAHO. Arco, Butte County, *Macbride & Payson 3097* (CAS, GH, NY, POM, US). MONTANA. Red Hill, Madison County, *C. L. Hitchcock 16928* (RB, WTC, WTU). Melrose, Silver Bow County, *Rydberg 2716* (NY, type of *A. viscidulus).* Haystack Mt., Stillwater County, *Tweedy 120* (NY, type of *A. viscidulus depressus), Hitchcock & Muhlick 13399* (CAS, RB, US, WTC). MINNESOTA. South Fowl Lake, Cook County, *Butters, Abbe & Burns 611* (MINN, type of *O. ixodes,* GH). WYOMING. Laramie Peak, Albany County, *A. Nelson 7519* (GH, NY, POM, US). Between Eden and Big Piney, *E. & L. Payson 2584* (GH, NY, POM, US). Wind River, Fremont County, *Parry 89* (GH, NY). Yellowstone Park, *Parry 87* (GH[8]). NEVADA. East Humboldt Mts., *Watson 292* (GH, NY, US). UTAH. Clear Creek Pass, Mt. Hilgard, Sevier County, *Eggleston 10360, 10361* (US). COLORADO. South Park, Park County, *Wolf 352* (GH, UC, US). CALIFORNIA. Thunder and Lightning Lake, Inyo County, *J. T. Howell 23988* (CAS, RB).

Oxytropis viscida is extraordinarily variable in aspect and detail and seems to be in process of fragmentation. Material from almost any given station or restricted region has a more or less distinctive appearance, probably genetically controlled. But when the diversity is analyzed, it is found to consist of an interchange of rather few and in the genus trivial characters, no one of them unique to any single race but combined in various ways. The strictly typical phase, as collected by Nuttall and known from a few other collections from Wyoming, has the scape and inflorescence copiously white-villous, the stipules strongly pilose dorsally as well as ciliate, and small whitish flowers, with immaculate keel 8–9 mm. long. In western Wyoming a white-villous form occurs in which heavily pubescent stipules are combined with purple flowers, or with ochroleucous banner and maculate keel. And this passes gradually into the state known as *Aragallus viscidulus,* in which the flower is, or may be, somewhat larger (the keel 9–11 mm. long), the corolla bright purple, the calyx and whole inflorescence either dark-strigose, fuscous-pilose or dark-strigose with an admixture of longer and looser pale hairs. Here the scapes may be appressed-pilose, or glabrate, and the stipules either pubescent or nearly glabrous dorsally. Rydberg attempted to distinguish *O. viscidula* from *O. viscida* by the absence of yellow hairs on the caudex-branches (meaning their thatch of marcescent stipules), by the shorter, dark vesture of the calyx, scape and pod, and by the more gradually long-acuminate pod. Comparison of the types of these species shows that the stipules are equally pilose in both; while we now have examples of gradually and abruptly acuminate pod combined with either pale or fuscous vesture and with either purple or ochroleucous flowers. Jones (Montana Bot. Notes, 38) has shown how unreliable is the color of the calyx-hairs in *O. viscida,* as it is indeed in most other species. Although Hultén maintained both *O. viscida* and *O. viscidula* in the Flora of Alaska and Yukon, he there admitted (p. 1108) that "the difference between [them] lies merely in the degree of pubescence, and some collections could only be more or less arbitrarily separated into the respective species"; and his maps (nos. 838, 839) show that the areas of the two are not significantly different in Alaska.

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[8] Parry's *Nos. 87 and 89* are labelled "N.-W. Wyoming," but cf. Jones, Rep. Reconn. N.-W. Wyo., 310. The first collection formed part of the original *O. monticola* Gray; cf. discussion of *O. campestris* var. *gracilis,* below.

The purple-flowered Minnesota plant, *O. ixodes,* was said to differ from *O. viscidula* in its larger and more numerous leaflets, longer broader petals, longer and narrower "sepals," and more deeply sulcate legume. All these features are duplicated somewhere, if not together, in cordilleran material of *O. viscida,* and had the specimens originated in Wyoming, rather than in a station remote from the main area of the species, they would have been referred without doubt or difficulty to that species.

Yet further isolated, on the Olympic Peninsula in Washington, and on Gaspé Peninsula in Quebec, there are two forms of *O. viscida* which have somewhat better claim to recognition. The first has a pale and immaculate corolla, and the vesture nearly of typical "*O. viscidula,*" with dark hairs predominating in the inflorescence, and usually small and closely approximate leaflets. Material of it was referred by St. John (Proc. Biol. Soc. Wash., 41:103, 1928) to his *O. olympica,* and by G. N. Jones (Univ. Wash. Pub. Bot., 5:189, 1936) to *O. luteola,* both of which are, strictly speaking, forms of the eglandular *O. campestris.* The viscid *Oxytropis* of Gaspé *(O. gaspensis)* is again pale-flowered, but the keel is maculate, and the other petals are said to be "white changing to pale pink," "pale lilac," or "creamy." Here the scape and inflorescence are thinly white-villous, the vesture similar in quality to that of Nuttall's *O. viscida,* but the calyx-teeth (1.5–2 mm. long) are shorter than in nearly all cordilleran forms, whether white or purple-flowered.

The populations of the Olympics, Minnesota, and Gaspé, evidently relicts of a wide pre-glacial distribution, present a special problem. If held distinct, they are actually or very nearly spot endemics, *O. gaspensis* confined to the flanks of a single mountain, *O. ixodes* to two slate talus slopes a few miles apart (it has been reported from District of Mackenzie; cf. Sargentia, 6 : 209), and the Olympic race to a single ridge in that range (and perhaps the Wallowa Mts., Oregon, whose local race is closely similar). In their restricted ranges they remain nearly monomorphic and are not *precisely* like anything from the main area of variable *O. viscida.* At the same time there are many small races of *O. viscida* isolated on mountain peaks or on dry knolls in the foothills of the Rocky Mountains which differ among themselves to as great a degree and in the same or equivalent directions. These also can be considered spot endemics, for their individual isolation (as on the East Humboldt Mts., Nevada, for example) is as complete, even though far less dramatic, as that of *O. gaspensis.* Just as *O. ixodes* in the type-locality differs from that in the nearby Canadian station (fma. *ecaudata)* in the length of the stipule-blades, so do little races of *O. viscida* from neighboring mountain ranges in the West differ, with apparent constancy, in length of keel, incidence of dark or light, spreading or appressed hairs, length of legume, and other details. Once the combination presented, for example, by *O. gaspensis,* is accepted as of taxonomic importance, it is inconsistent to pass over other combinations of equivalent value. Montana and Wyoming alone harbor half a dozen entities of the order of *O. gaspensis.* Rather than attempt such minute discrimination, which is bound to be reduced at length into extremes of "Jordanism," it has seemed prudent to demote *O. gaspensis, O. viscidula,* and *O. ixodes* to the rank of minor variants.

Typical *O. viscida* fluctuates between a mesophytic extreme from moist meadows, with ample thin leaflets, long scapes, and open fruiting racemes, and a reduced subalpine state *(Aragallus viscidus depressus)* in which the leaflets are fewer, thick, and crowded, the scape short (as little as 3 cm. long) and the raceme few-flowered and subumbellate. This dwarf plant simulates and nearly approaches var. *hudsonica,* from which it is distinguished principally by its longer and prominently verrucose calyx-teeth. And some plants from high latitudes (e. g. *Kusche in 1916,* from Whitehorse, Yukon, CAS, which includes individuals with abbreviated and longer teeth in the same collection) are quite intermediate in this respect.

Oxytropis viscida is closely related to the vast and variable *O. campestris,* and hybridization often occurs where the two species come into contact. On

Hurricane Ridge in the Olympic Mountains, the white-flowered local form of *O. viscida* is associated with *O. campestris* var. *gracilis*, and several collections have been seen which are intermediate between them in some characters. The var. *gracilis* is devoid of glands and, in this station, its leaves and bracts are copiously appressed-silky, in contrast to the viscidity, sparse and looser vesture, verrucose calyx-teeth, and dorsally glabrous bracts of the other. Specimens intermediate in pubescence and combining sparsely pilose bracts with glandular calyx-teeth are pretty certainly of hybrid origin (cf. Hurricane Ridge, *G. N. Jones 3219, 4015,* WTU). Similarly in the foothills of the Alberta Rockies there is a peculiar plant which perhaps springs from crosses between *O. viscida,* always purple-flowered in that area, and the form of *O. campestris* var. *gracilis* with some geminate leaflets. The extraordinary similarity between such purple-flowered plants from Bow River west of Calgary *(Moodie 143,* NY), with a few geminate leaflets, subglabrous bracts, and verrucose calyx-teeth, and those from Banff *(Butters & Holway 14,* GH, NY) or Brazeau *(Stewardson Brown 1062,* NY), differing only in the lack of warts or apparent viscidity, could be conveniently explained by assuming that the first, otherwise pure *O. viscida,* has inherited its paired leaflets and some hairs on the bracts from var. *gracilis,* while the others, otherwise quite like the prevailing var. *gracilis* of the region, have derived their purple flowers from *O. viscida.* The Alaskan plants quoted by Hultén (Fl. Alaska and Yukon, 1109) as having "glandular calyx-teeth and a tendency to verticillate leaflets," not seen by the writer, could represent a cross involving *O. campestris* var. *varians.* It is equally possible, however, that a potentiality for paired leaflets exists in the species as a whole. It is difficult to accept the theory of hybridization in the case of the remarkable plants from Colorado (Dillon, *Eggleston 11952,* US; Blue River, n. of Breckenridge, *Ripley & Barneby 10468,* CAS, NY, WYO), among which are found some of the most extreme examples of paired leaflets yet encountered in *O. viscida;* for the requisite other parent (unless it is here *O. splendens,* which seems highly improbable) does not range so far south. The eglandular plant with some geminate leaflets from Alberta closely matches specimens in the herbaria of Gray and Torrey received from Hooker as "*O. Lambertii β,*" and doubtless represent that variety as treated in Flora Boreali-Americana and in Torrey and Gray's Flora. When Bunge wrote of *O. Lambertii:* "foliola . . . saepe quaternatim verticillata," he was probably referring to part of this collection, presumably taken by Drummond in Alberta. In the herbarium of the New York Botanical Garden it was found that Rydberg had set aside "*O. Lambertii β*" (eglandular) and *Moodie 143* (glandular) in a species-cover under an unpublished name commemorating Drummond; probably he intended to publish a species based on these specimens. But the true status of this most interesting form is still to be established. The glandular state is illustrated in S. Brown, Alp. Fl. Canad. Rocky Mts., opp. p. 176, 1907.

14b. **Oxytropis viscida** Nutt. var. **hudsonica** (Greene) Barneby

Oxytropis viscida Nutt. var. *hudsonica (Greene)*, stat. nov. *Aragallus hudsonicus* Greene, Proc. Biol. Soc. Wash., 18:17. 1905. *Oxytropis hudsonica* (Greene) Fern., Rhodora, 30:142, Pl. 172, both upper and lower figs. 1928.

Similar to var. *viscida* but low, the leaves 2–6 (10) cm., the scapes 2.5–7 cm. long, the latter sparsely villous-pilose; leaflets 19–33, 1.5–6 mm. long; racemes densely 3–9 (16) -flowered, the axis scarcely exceeding 1 cm. long in fruit; calyx pilose with fuscous or rarely pale hairs, 7.5–8 mm. long, the tube 6–6.5 mm., the deltoid-subulate teeth 1–1.5 mm. long, not or quite obscurely verrucose; corolla ''reddish-purple''; pod not or obscurely granular-verrucose, short-pilosulous with light or dark hairs. *Type* collected by A. P. Low, in 1896, at Whale River, Hudson Bay; *Low 14272* (ND)!

Distribution: Arctic and subarctic shores around Hudson Bay, north to Melville Peninsula, eastward to Great Bear Lake and the Mackenzie Mountains. Map 7.

Representative specimens: Mackenzie. Great Bear Lake, *Bell 22895* (GH). Keewatin. Ranken Inlet, *J. Macoun 79104* (NY). Franklin. White I., Frozen Strait, *Angel 51, 53* (US). Ontario. James Bay, *R. H. Smith 89* (US). Quebec. N. of Cape Jones, Hudson Bay, *Low 63166* (GH, NY).

The var. *hudsonica* is closely related to var. *viscida,* differing principally in its diminished stature, short calyx-teeth and less marked viscidity, the glandular verrucae being almost lacking, or from the calyx-teeth completely so. None of these characters is of itself absolutely diagnostic, but together they mark a distinctive population of eastern Arctic and subarctic distribution. Like var. *viscida,* it is variable in flower-size, in the number of flowers to the raceme, and in the color of the pubescence, the calyx varying from fuscous to white-pilose. The leaflets may be nearly glabrous, with a few scattered hairs on the elevated margins, or loosely pilose on both sides; but the lower surface is commonly less hairy than the upper and, as in most of var. *viscida,* corrugated when dry.

Reports of var. *hudsonica* from Alaska, as pointed out by Raup (Sargentia, 6: 207, Pl. xxx [map], 1947), are based on misidentifications; and the western limit of the variety has not been clearly determined. Porsild (Sargentia, 4: 53, 1943) cited several collections from the Mackenzie Delta region, and Raup had both var. *hudsonica* and *O. ixodes* (presumably a form of var. *viscida)* from Brintnell Lake in southwestern Mackenzie. But this material has not been seen.

The little plant labelled ''Melville Island'' (GH, without collector's name) which was illustrated by Fernald (Rhodora, 30, Pl. 172, 1928) as

O. arctica has dorsally glabrous bracts and thick, sparingly pilose leaflets. If this is really the plant described by Robert Brown from Melville Island, the name *arctica* is misapplied in this paper. However the description of *O. arctica* in Chloris Melvilleana calls for a sericeous plant, with 11–17 leaflets (so described by Fernald, also op. cit., p. 144), whereas the subject of the photograph is glabrescent and, as a glance reveals, the leaflets are 21 or 23 to the leaf. Note also the striking similarity between the supposed "*arctica*" and the isotype of *Aragallus hudsonicus* side by side on the cited plate. They are surely conspecific, and *O. arctica* is something else again. The origin of this controversial specimen, which Fernald described as a duplicate type of *O. arctica*, is quite doubtful in spite of the fact that it is labelled "Melville Island." Polunin (Bot. Canad. E. Arct., 292, 1940) pointed out that some of the plants from Parry's explorations (of which this is probably one) are not from the First Voyage and therefore must have come from points far south and east of Melville Island, in the region of Hudson Strait and Melville Peninsula. Very likely this is a case in point. There is no modern evidence of the presence of var. *hudsonica* on Melville Island whereas Polunin noted a specimen of it in the British Museum collected on Pary's Second Voyage at Igoolik Island (Melville Peninsula, at about 69° N.), apparently the most northerly known station.

14c. **Oxytropis viscida** Nutt. var. **subsucculenta** (Hook.) Barneby

Oxytropis viscida Nutt. var. *subsucculenta* (Hook.), comb. nov. *O. uralensis β subsucculenta* Hook., Fl. Bor.-Amer., 1:146. 1831.

Astragalus leucanthus Pall., Astrag., 59, Pl. 47. 1800. *Oxytropis leucantha* (Pall.) Pers., Syn., 2:331. 1807. *Spicsia leucantha* (Pall.) O. Kze., Rev. Gen., 206. 1891. *Aragallus leucanthus* (Pall.) Greene, Pittonia, 3:211. 1897.

Oxytropis borealis DC., Prod., 2:273. 1825.

Oxytropis borealis β H. & A., Bot. Beechey Voy., 122. 1832.

Oxytropis campestris var. *verrucosa* Ledeb., Fl. Ross., 1:591. 1842.

Usually low, the leaves 7–10 cm., the scapes 4–12 cm., rarely up to 18 cm. long; leaflets 19–25 (37); inflorescence and upper part of the scapes densely hirsute with fuscous or mixed black and paler hairs, the longer hairs occasionally lacking below the inflorescence; racemes subcapitately 5–10-flowered, the axis (0.5) 1–2 (2.5) cm. long in fruit; calyx 8–10 (12) mm. long, the tube 5–6 mm., the teeth (2) 3–4 (8) mm. long; petals purple, lilac or whitish, the banner (13.5) 15–18 (22) mm. long, 5.5–7 mm. broad; wings 12.5–15 mm. long, the blades (7) 8–11 mm. long, (3.5) 4–5 mm. wide near the dilated apex; keel 11–13 mm. long, the appendage commonly minute. *Type* collected by Dr. Richardson, on the "Arctic seashore, to the east of the Mackenzie River."

Distribution: Arctic shores, from "Mackenzie" to Behring Strait, south to interior Alaska and Alaska Peninsula, and westward from Okhotsk Sea to the Aldan River, Siberia. Map 7.

Representative American specimens: ALASKA. Castner Glacier, Alaska Range, *A. & R. Porsild 495* (GH). Alalaqoqshuk Mt., Katmai Nat. Mon., *Henning 516* (US). Nome, *Grace Hill 104* (US). Point Lay, *Mason in 1931* (CAS, UC).

The relatively few leaflets, ample flowers, and condensed, copiously hirsute inflorescence combine to make var. *subsucculenta* striking to the eye, but it seems scarcely possible to maintain it as a species distinct from *O. viscida* on substantial characters. In fact there is no absolute criterion. In var. *viscida,* as here treated, the calyx-teeth are quite variable, occasionally reaching 4 mm. in length, the leaflets can be as few as 19 in the developed leaves, the wing-petals may rarely be dilated upward and as much as 4 mm. broad (though usually much narrower), and a few examples of densely hirsute raceme have been noted. Gray (Proc. Amer. Acad., 20:5) contrasted the oblong spike, white-hairy calyx, and small puberulent pod of *O. viscida* with the congested raceme, dark-hairy (in spite of one instance of white-hairy) calyx, and larger black-villous pod of "*O. leucantha.*" While the length of the raceme still appears to be a rather stable character, the color of the hairs is without value, the very type of var. *subsucculenta* being white-hairy. Little good fruit of var. *subsucculenta* (or *O. leucantha)* has been available for comparison, but the few pods examined seem quite similar in all respects to that of var. *viscida,* itself most variable in length, in development and direction of beak and style, and in color and density of vesture.

The epithet *subsucculenta* has been taken up for the *O. leucantha* of most authors on the basis of data most kindly contributed by Mr. N. Y. Sandwith, of the Royal Herbarium, Kew Gardens. At the writer's request Mr. Sandwith examined the type at the British Museum, labelled "*O. uralensis β*" in Hooker's hand[9], and found it to be a glandular plant, with calyx-tube 7 mm. and verrucose teeth averaging 3 mm. in length. These dimensions of the calyx rule out the possibility that the plant can represent var. *hudsonica,* which the type-locality, "arctic sea-coast," might otherwise suggest; and the "fine head of beautiful big flowers," as described by Sandwith, as well as smaller details of his description, point to what is known to American botanists as *O. leucantha.* Although we have no modern record of the variety from east of the Mackenzie Delta, there is also no reason to believe that var. *viscida* extends north of the Arctic Circle. Unless there is a fourth glandular *Oxytropis,* otherwise unknown to the writer, in boreal America, the identity of *O. leucantha* and *O. uralensis β subsucculenta* seems established.

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[9] A copy of Mr. Sandwith's extensive notes has been deposited in the herbarium of New York Botanical Garden.

In the absence of pertinent types it is best to follow Bunge's disposition of *Astragalus leucanthus, Oxytropis borealis,* and *O. campestris* var. *verrucosa* as synonyms. Only one viscid member of the genus is known from the environs of Behring Strait, so that var. *verrucosa*, described as "undique . . . verrucis vel tuberculis subnigricantibus . . . dense obtecta," can be applied with some assurance to the plant on the American side. Bunge expressly referred var. *verrucosa,* as well as Wright's collection of var. *subsucculenta* from Arakamtchtchene Island (GH, US) to *O. leucantha,* and there can be little doubt as to their identity.

The reduction of *O. borealis* is taken on faith from Bunge and is of interest here only in so far as the name was tentatively applied by Fernald to an eglandular plant of coastal Mackenzie (cf. discussion of *O. campestris* var. *varians,* below). The species was described by DeCandolle from specimens acquired from Fischer and is said to have originated, like the type of var. *verrucosa,* "in terra Tschuktschorum ad sinum Sancti-Laurentii"; the collector is not stated. The description in the Prodromus fails to note viscidity or glands, but otherwise fits var. *subsucculenta* well. Ledebour (Fl. Ross., 1:191) stated, on the authority of Schrenk who had seen DeCandolle's type, that *O. borealis* was a synonym of *O. campestris* var. *sordida,* an eglandular plant of Arctic Europe which probably reaches its eastern limit in Novaya Zemlya; but this seems nearly impossible. Since Bunge inferred that he had seen authentic material of *O. borealis* in Fischer's herbarium, and reduced it without comment to *O. leucantha,* there is no reason to question the opinion of the monographer, accepted by Gray and lately confirmed by Vassilczenko and B. Fedtschenko in Flora U. R. S. S.

15. **Oxytropis campestris** (L.) DC.

Oxytropis campestris (L.) DC., Astrag., 59. 1802. *Astragalus campestris* L., Sp. Pl. 761. 1753, sensu ampliatissimo.

Very variable in stature and pubescence, green and glabrate to densely silky-pilose, or sometimes villous-hirsute, especially as to scape and petiole; stipules membranous, pale, glabrous to pilose dorsally, the free blades triangular to lance-acuminate, 1–3-nerved, the margins naked or ciliate with bristles and rarely with clavate processes; leaflets 7–45, scattered, opposite, or sometimes geminate and pseudo-verticillate; scapes decumbent or erect, 2.5–30 cm. long; bracts pilose dorsally, very rarely glabrate; racemes 5–30-flowered, capitate to oblong, sometimes much elongating and narrow, 0.5–11 cm. long in fruit; calyx loosely pilose with pale, fuscous, or commonly mixed hairs, the tube (4) 4.5–7 mm., the teeth 1–4 mm. long; corolla white, ochroleucous, pale yellow, purplish or bright purple; banner 12–20 mm. long, 4–8 (9) mm. wide; wings 10–17 mm. long, the obliquely oblong, truncate or emarginate blades usually not much dilated upward, (1.5)

3–4.5 (6) mm. wide at apex; keel (9) 10–15 mm. long, the appendage commonly small; pod sessile or nearly so, strict or somewhat spreading, the oblong to obvoid-ellipsoid, somewhat tumid body (5) 8–16 mm. long, passing into a straight or variably divaricate beak about 5 mm. long, the valves membrano-chartaceous, not rigid, shortly pilosulous, the ventral suture inflexed to traverse half or nearly the whole width of the cavity, the dorsal suture filiform or rarely raised within as a narrow and incipient septum.

From the earliest days of botanical exploration in North America the name *O. campestris* has figured in the literature. For the most part the plants of the New World have been held varietally distinct from the Linnaean *Astragalus campestris,* but the belief that true *O. campestris* is native, at least in high latitudes, has found expression as lately as 1943. In 1871 Watson (Bot. King, Append., 447) recorded *O. campestris* as ranging from the Arctic to Maine and Colorado; and three years later Bunge (Gen. Oxytr., 107) accepted the species as west European, east Asian (to Sakhalin) and western North American, noting however that the latter, "robustiore, elatiore, racemo dissitifloro" differed somewhat in stature and habit. The purple-flowered plants of eastern North America were doubtfully referred by Bunge to *O. sordida* (Wahlenb.) Pers., an Arctic European species which has been widely and no doubt correctly regarded as a variety of *O. campestris.* Gray's second revision (1884) excluded typical *O. campestris* from the American flora for the first time, the material which had been so named hitherto being divided between a western Arctic "*O. leucantha*" (at the time an imperfectly known entity), a purple-flowered eastern *O. campestris* var. *coerulea* (the *O. sordida* of Bunge), and a new species, *O. monticola,* largely cordilleran and ochroleucous-flowered. Fernald has since shown that behind Gray's var. *coerulea* (not var. *coerulea* Koch) there lurked two perfectly distinct endemic entities, *O. johannensis* and *O. terrae-novae,* and went far to explain the idea of an arctic *O. campestris* or *O. campestris* var. *melanocephala* of early authors. During the present century the far Western and Rocky Mountain forms have been elaborately segregated by Aven Nelson, Greene, Rydberg, St. John, and others, until we now have more or less current in floristic or monographic works no less than fourteen species in an area where Watson could see only *O. campestris* and Gray only *O. monticola.*

The foregoing summary of the literature will suffice to show that a return to the concept of an American *O. campestris* is by no means a revolutionary step. While it is argued here that *O. campestris* in its original and narrowest sense is, as Gray and most modern botanists have concluded, absent from the New World, nevertheless the European and American plants can reasonably be ranked as geographic populations within a polymorphic, circumboreal species. These races, treated below in the category of varietas, are alike in flower and, except for the occasional production

Table I. Variation in some critical organs of American O. campestris.

	Campestris (European)	Varians	Alaskana type	Gracilis	Villosa (type)	Luteola (& *olympica*)
STIPULES						
p[ilose], gl[abra]te or gl[abrous] dorsally	p, gte	p, gte	p	p. gte	thinly p	thinly p, gte
length of free blades (in mm.)	2–12	2–8	8–12	3–12	ca. 6	3–11
margins g[labrous], c[iliate], or bearing glandular p[rocesses]	g, or c, p	c, p	c, p	g, or c	c	± c
LEAVES						
length (in cm.)	6–20	3–21	7–17	6–20	7–11	4–17
number of leaflets	17–33	13–45	19–25	17–33	23–29	17–25
length of leaflets (in mm.)	4–16	2–24	5–20	3–23	7–13	4–16
SCAPES						
app[ressed-pilose] or spr[eading-pilose]	app or spr below	app, spr	spr	app or spr below	spr	app or spr below
length (in cm.)	6–20	3.5–24	15–20	7–30	8–13	9–16
RACEMES						
number of flowers	5–12	6–25	15	6–30	12–18	7–16
length of fruiting axis	1–4	0.5–10	1–3	2–10	ca. 3	1–5
CALYX						
length (in mm.)	7–9	6–8	7.5	7–10	7.5	6.5–9.5
tube (in. mm.)	5.5–6.5	4–6	5.5–6	4.5–7	5.5	5–7
teeth (in mm.)	1–2.5	1.2–3	1.5–2	1.5–3	2	1.5–3
COROLLA						
ochr[oleucous], wh[itish], with mac[ulate keel], p[urple], or p[urpli]sh	ochr or psh	ochr, wh	ochr	ochr, wh, rarely mac	ochr	ochr
banner: length x width (in mm.)	15–20 x 4–6	12–17 x 5–7	15–18 x 6–7	12–19.5 x 4–7	15 x 6	14–19 x 4.5–6
wings: total length x width of blade (in mm.)	13–15.5 x 1.5–4	10.5–15 x 3–4	13–14 x 3.5–4	10–16 x 2.5–4	12 x 3.5	14–16.5 x 2.5–4
keel: length, including appendage (in mm.)	12–14	10–12	12–13	10–14	11.5	13–15
MISCELLANEOUS	pod obscurely septate dorsally	leaflets sometimes geminate		leaflets sometimes geminate	a few leaflets geminate	

Cascadensis (& *Mazama*)	Okanoganea (& *cervinus*)	Columbiana	Dispar	Cusickii (& *Paysoniana*)	Rydbergii	Johannensis	Chartacea	Terrae-novae
gl or glte	densely p or gte at tip	densely p, rarely gte	strongly p	thinly p gte, g	gte	densely p, or gte	densely p	g or gte
4.5–10	4–15	2–7	4–14	2–7	4–8	3–18	4.5–12	2–7
± c	c	c	c	± c, or g	c	c or nearly g	c	sparsely c, or g
5–18	6–23	5–17	5–21	3–12	1.5–7	4–26	8–21	2–13
15–28	13–23	11–17	19–25	7–17	7–13	17–29	21–27	11–27
3–18	7–27	9–30	4–20	4–23	3–11	3–29	5–20	2–10
app	app or spr below	app or spr below	± spr	app	app, rarely spr	app	spr	app
6–21	15–27	13–30	7–18	5–19	2.5–10	4–36	10–25	3–16
6–20	9–22	6–28	8–15	6–15	3–8	7–14	10–20	3–9
1.5–3	5–11	2–10	2–6	1–3 (6.5)	0.5–1.5	1.5–11	2–13	0.3–1.5
7–9	7–9	7.5–10	8–9	7–10	7–9	6–8	6–8	5–7
5–6	4.5–7	5–6.5	6–6.5	5–7	5–6.5	5–6	4–6.5	4.5–6
2–4	1.5–3	2–4	2–2.5	1.5–3	2.5–3	1–3	1.5–2.5	0.5–1.5
ochr	ochr	wh, mac	ochr, wh, mac, p or psh	ochr	ochr (?mac)	p	p	p
14–17 x 5–7	16–18 x 6–9	15.5–20 x ca. 6	17–19 x 6–8	14–20 x 5–8	14–18 x 5–7	12–18.5 x 6–8.5	13–15 x 5–7	11–18 x 4.5–6
11–14 x 2.5–3	14–16 x 2.5–5.5	13–17 x 3–4	14–16 x 4.5–6	11.5–15 x 3–4.5	11.5–15.5 x 3.5–4.5	13–15.5 x 3.5–5.5	11–14 x 4–5	10–15 x 3–4.5
11–13	12.5–14.5	11–14	ca. 13	11–14	11–14	10–13	10–12	9–13

of a vestigial dorsal partition, in structure and texture of the pod. The visible differences, sometimes very great, are matters of stature, number of leaflets, length and density of the raceme, and number and color of the flowers. The type and degree of variation in flower-size and in the orientation or amount of vesture are remarkably uniform throughout the complex, villous-hirsute and appressed-pilose, or large and small-flowered states being encountered in nearly every race of which representative material is available. With a slight shift of emphasis from the superficial differences to the many fundamental similarities the acceptance of an American *O. campestris* becomes inevitable. In order to present more vividly than would be possible in a running account the types of variation noted in this puzzling group of forms, the accompanying table has been compiled. The figures in it are perhaps somewhat casuistic in effect, since the inclusion of unusual extremes tends to mask prevailing tendencies in one or more directions. But in general it serves to express the essential similarity of many ''species'' which have been subordinated in rank or reduced to synonymy.

The presence of an incipient dorsal septum in the pod of European *O. campestris,* alluded to above, was so highly regarded as a criterion by Bunge that it deserves further comment. In his monograph of the genus Bunge actually separated two sections, *Orobia* and *Diphragma,* by this single character. He himself expressed doubt as to the naturalness of the resulting arrangement, pointing out that some members of *Orobia* seemed to find closer affinities in *Diphragma* than within their own section; and simultaneously he admitted to section *Gloeocephala,* which differs from *Orobia* and *Diphragma* only in having a glandular pubescence, species with both types of legume. The partition in the pod of *O. campestris,* sensu stricto, is extremely narrow and at times may be nearly obsolete, while in our cordilleran plants the dorsal suture of the pod, although nearly always naked and filiform, is occasionally a trifle thickened and elevated within. At this point the pod is inseparable from that of the European plant, and the importance of the character has no doubt been overestimated.

Key to the American Varieties of O. campestris

1. Petals white or ochroleucous or, if purple, the leaves strongly dimorphic and the valves of the pod rather firm; west of the 90th meridian and Hudson Bay 2

— Petals (except in an occasional albino) purple; leaves not strongly dimorphic; pod thin-chartaceous; east of the 90th meridian, Wisconsin, Maine and Quebec to Hudson Strait 6

2. Stipules (or at least some of them) bearing clavate processes on the margins of the free blades, these often mixed with bristly ciliae; Alaska to n.-e. Manitoba and n. British Columbia.......... 15a. var. *varians*

— Stipules devoid of clavate processes, the blades glabrous or ciliate; widely diffused in w. North America from the Canadian Rockies southward.......... 3

3. Corolla purple or polychrome (i. e. with flowers of many shades, including white, in the same colony); stipules and herbage densely and permanently pilose; prairies of North Dakota........ 15d. var *dispar*

— Corolla uniformly white or yellowish, the keel very rarely purple-tipped...... 4

4. Petals concolorous, the keel immaculate or, if maculate, the leaflets more than 17 to the developed leaf, or the scapes low, less than 1 dm. long........ 5

— Petals white with prominently maculate keel; leaflets 7–17. Robust riparian plants of the Columbia River above the mouth of the Spokane in Washington, and of the Flathead River in n.-w. Montana........ 15e. var. *columbiana*

5. Leaflets 17–33 in number or, if less, then tall plants of middle elevations in n. Washington and British Columbia with densely silky stipules, or the scapes (except in depauperate individuals) 1.5–3 dm. tall, or the racemes loose and 5–11 cm. long .... 15b. var. *gracilis*

— Leaflets 7–17 in number; low alpine or subalpine plants of the higher Rocky Mountains, the scapes 1.5–15 cm. long; stipules glabrous or glabrate dorsallly; fruiting racemes rarely surpassing 4 cm. in length........ 15c. var. *Cusickii*

6. Racemes 3–8-flowered, not elongating, the axis 3–15 mm. long in fruit; calyx-teeth deltoid, 0.5–1.5 mm. long; plants low, the scapes usually arcuate-ascending, 3–16 cm. long........15f. var. *terrae-novae*

— Racemes 7–14-flowered, elongating in fruit, the axis becoming (1.5) 2–11 cm. long in fruit; calyx-teeth commonly lanceolate, (1) 2–3 mm. long; plants more robust, the scapes erect, 10–36 cm. long........ 7

7. Pod 14–27 mm. long; stipules glabrous to sparingly pilose dorsally; pubescence of the scapes and herbage usually subappressed; Maine to Gaspé and Newfoundland .... 15g. var. *johannensis*

— Pod 8–13 mm. long; stipules more densely pilose dorsally; pubescence of scapes and herbage looser and more copious; Wisconsin........ 15h. var. *chartacea*

15a. **Oxytropis campestris** (L.) DC. var. **varians** (Rydb.) Barneby

Oxytropis campestris (L.) DC. var. *varians* (Rydb.), stat. nov. *Aragallus varians* Rydb., Bull. N. Y. Bot. Gard., 2:176. 1901. *Oxytropis varians* (Rydb.) K. Schum., Just's Jahresb., 29^1:543. 1903; Hult., Fl. Alaska & Yukon, 1107, map 839. 1947 (as "comb., nov.").

? *Oxytropis alaskana* A. Nels., Univ. Wyo. Pub. Bot., 1:120. 1926.

Oxytropis hyperborea Porsild, Sargentia, 4:53. 1943.

Variable in stature and pubescence, the herbage copiously silky-pilose, or somewhat hirsute, or glabrescent; stipules pilose dorsally, the margins beset with bristly ciliae and some clavate processes; leaves 3–15 cm. long; leaflets (11) 15–45, either scattered, subopposite, or geminate and pseudoverticillate, especially on the secondary leaves; scapes ascending or erect, 3.5–24 cm. long; racemes (6) 10–24-flowered, ovoid to subcylindric at anthesis, the axis becoming (0.5) 2.5–10 cm. long in fruit; calyx pilosulous with black and pale hairs in varying proportions, 6–8 mm. long, the tube 4–6 mm., the teeth (1.2) 1.5–3 mm. long; petals ochroleucous, or rarely yellow, the keel occasionally maculate; banner 13–15 (17) mm. long; wings 12–15 mm. long, the blades 3–4 mm. wide; keel 10.5–12 (13) mm. long.

Type collected by J. B. Tarleton, in 1899, on the Lewes River, Yukon; *Tarleton 33b* (US)!

Distribution: Rocky hillsides, moraines, arctic and subarctic shores, or in meadows along streams, coastal Mackenzie to Alaska, northern British Columbia and northeastern Manitoba (on Hudson Bay). Map 8.

Representative specimens: Alaska. Yukon River, between Tanana and Rampart, *L. J. Palmer 57* (US)*[10]. McKinley Park P. O. *A. & R. Nelson 3658* (NY, WTC, WTU, WYO). Copper City, *Went 200* (UC), *Hiedeman 85* (US)*. Matanuska, *J. P. Anderson 899* (US). Skagway, *Eastwood in 1914* (CAS). Yukon. Whitehorse, *Eastwood 610, 611, 612* (CAS). Takhini River, between Whitehorse and Champagne, *Michel 46* (UC)*. Mackenzie. Fort Good Hope, *Onion in 1861–1862* (NY)*. Bernard Harbor, *Johansen 332* (NY). British Columbia. Lake Atlin, *Eastwood 680a* (CAS, US). Manitoba. Churchill, *Macoun 79102* (GH, NY).

The epithet *varians* is most appropriate to the present variety, for it is indeed variable in stature, vesture, length of stipule-blades, length of scapes and leaves, number and disposition of the leaflets, number of flowers to the raceme, and length of calyx-teeth, evidently composed, in fact, of numerous small races. The extremes in stature and in number of leaflets are approximately as great as those found in the cordilleran vars. *gracilis* and *Cusickii* combined, but it is impossible to sort the Alaskan material into two categories on the basis of these characters. Neither is it possible to admit the existence of two species from the far Northwest marked by the presence and absence of paired leaflets in some of the leaves, maintained by Porsild, as *O. hyperborea* and *O. campestris*, and by Hultén, as *O. varians* and *O. gracilis*. The degree to which the leaflets are geminate, and the number so disposed, are inconstant in plants of the same collection, or in collections from the same locality, and are correlated neither with the shape of the stipule-blades, the color of the calyx-hairs, nor with the density of the vesture. Curious and striking though it be, the character of pseudo-verticillate leaflets is now known to occur sporadically in several species, such as *O. viscida*, *O. arctica* and *O. campestris* var. *gracilis* in America, as well as in the Kamtchatkan *O. erecta* Kom., and can no longer be given much weight when supporting characters are lacking.

The var. *varians* is very close to the European race of *O. campestris*, and Porsild's identification of the arctic American plant with relatively few, non-verticillate leaflets as the Linnaean species is hard to refute. The stipules of both bear clavate processes on the margins of the blades and no absolute quantitative difference has been found in any single organ. Prevailingly, however, the scapes and racemes of var. *varians* are more drawn out, so that the average individual resembles var. *gracilis* rather than the European type. Dwarfed forms, such as are common in many herbaceous plants in high latitudes, are of frequent occurrence, and these differ from true *O. campestris* only in the smaller flower. Obviously the relationship is a close one, but they seem not to be identical. When dwarfed the European race does not have diminished flowers, and even in its largest phase the raceme remains few-flowered and condensed in fruit. In fact as it goes north in Arctic Europe it passes into the ampler-flowered var. *sordida;* whereas the American counterpart tends to become smaller-flowered within the Arctic circle. The two react differently to similar circumstances, have different (even though somewhat overlapping) ranges of variation, and seem therefore to deserve separate treatment.

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[10] Asterisk indicates some geminate leaflets present.

Hultén has referred all material of the *campestris* type (when lacking paired leaflets) to *O. gracilis*, and the writer has so annotated a number of herbarium sheets. The Alaskan and cordilleran plants are entirely similar, except for the presence in the former of clavate processes mixed with, or sometimes replacing, the bristly ciliae of the stipule-margins. These processes, which are deciduous from the ageing stipules, are known in several boreal species of *Oxytropis* such as *O. Maydelliana* and *O. arctica,* and although variable in quantity, seem to be a stable and characteristic attribute in the genus which can scarcely be ignored in this case, especially in view of the geographic segregation.

The flowers of var. *varians* are white or ochroleucous, drying straw-color, the keel concolorous or rarely maculate. In the type of *O. alaskana* A. Nels., which is here, as by Hultén, reduced to the common Alaskan species, the flowers appear to be yellow, as in *O. Maydelliana,* and the petals are all a little longer than usual in var. *varians.* On the supposition that this and a few similar specimens from Kenai Peninsula and the Lake Iliamna region might be derived from an *O. Maydelliana* x *campestris* var. *varians* cross, they have been mapped with the former species. It is as likely, however, that they represent a distinct variety or local population. The following collections are of the *O. alaskana* type:

Alaska. Kachemak Bay, Cook Inlet[11], *Gorman 1560* (WTU), isotype of *O. alaskana).* Halibut Cove, Cook Inlet, *Coville & Kearney 2418* (US). Seldovia, *Piper 4451* (US, WTC), *4445* (WTC). Lake Iliamna district, *Gorman 187* (CAS).

15b. **Oxytropis campestris** (L.) DC. var. **gracilis** (A. Nels.) Barneby

Oxytropis campestris (L.) DC. var. *gracilis* (A. Nels.) Barneby, Leafl. West. Bot., 5:111. 1951. *Aragallus gracilis* A. Nels., Erythea, 7:60. 1899 *Oxytropis gracilis* (A. Nels.) K. Schum., Just's Jahresb., 27^1:496. 1901.

Oxytropis Lambertii β Hook., Fl. Bor.-Amer., 1:107. 1834.

Oxytropis monticola Gray, Proc. Amer. Acad., 20:6. 1884, pro max. parte. *Spiesia monticola* (Gray) O. Kze., Rev. Gen., 206. 1891. *Aragallus monticola* (Gray)

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[11] Not, as claimed by Hultén, Fl. Alaska & Yukon 1098, from "Red Mountain (near Fort Selkirk)."

Greene, Pittonia, 3:212. 1897. *Astragalus Grayanus* Tidestr., in Tidestr. & Kitt., Fl. Ariz. & New Mex., 216. 1941, quoad nom. (non *A. monticola* Phil.).

Aragallus villosus Rydb., Bull. Torr. Club, 28:36. 1901. *Oxytropis villosa* (Rydb.) K. Schum., Just's Jahresb., 29[1]:543. 1903. *Astragalus Rydbergianus* Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937 (non. *A. villosus* Mchx.).

Aragallus luteolus Greene, Proc. Biol. Soc. Wash., 18:17. 1905. *Oxytropis luteola* (Greene) Piper & Beattie, Fl. N.-W. Coast, 337. 1915; A. Nels., Univ. Wyo. Pub. Bot., 1:117. 1926 (as "comb. nov.").

Aragallus albertinus Greene, Proc. Biol. Soc. Wash., 18:15. 1905. *Oxytropis albertina* (Greene) Rydb., Fl. Prair. & Pl., 484. 1932. *Astragalus albertinus* (Greene) Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937.

Aragallus cervinus Greene, Proc. Biol. Soc. Wash., 18:16. 1905.

Aragallus Macounii Greene, l. c., pro parte.

Oxytropis olympica St. John, Proc. Biol. Soc. Wash., 41:103. 1928.

Oxytropis Mazama St. John, op. cit., 101. 1928. *Astragalus Mazama* (St. John) G. N. Jones, Univ. Wash. Pub. Bot., 7:175. 1938.

Oxytropis okanoganea St. John, op. cit., 102. 1928.

Oxytropis cascadensis St. John, op. cit., 105. 1928.

Densely cespitose, or sometimes with openly branched caudex; herbage green and sparingly or finely pilose, sometimes permanently and densely silky-pilose, the scapes commonly bearing some divergent hairs at base, rarely villous-hirsute throughout; stipules almost glabrous to densely pilose dorsally, the free blades 3–15 mm. long, ciliate or eciliate; leaves somewhat dimorphic, 6–23 cm. long, the developed secondary ones with (13) 17–33 linear-oblong, lanceolate, or obovate leaflets 6–23 (30) mm. long, all commonly opposite or subopposite, or a few inserted in unequal pairs at the same point on the rachis; scapes erect, (7) 10–30 cm. long; racemes 10–30-flowered, usually dense at first and at full anthesis, much or but little elongating in fruit, when narrow and 2–11 cm. long; bracts pilose dorsally, sometimes sparingly so, shorter than to nearly twice as long as the calyx; calyx pilose or hirsutulous, often with some fuscous hairs, 7–9.5 mm. long, the tube 4.5–6.5 mm., the teeth 1.5–2.5 (3) mm. long; corolla whitish or ochroleucous; banner 12–17 (19.5) mm. long, 4–7 (9) mm. wide, wings 10–16 mm. long, the blades oblong, 2.5–4 mm. wide near the truncate or emarginate apex, rarely dilated upward and up to 5.5 mm. wide; keel 10–14.5 mm. long. *Type* collected by Aven Nelson, in 1896, in the Limestone Range of the Black Hills, Wyoming; Limestone Range, Weston County, Wyoming, *A. Nelson 2545* (GH, NY, US, isotypes)!

Distribution: Prairies, mountain meadows or open woodland, in moist or dry soils, from s.-w. Manitoba to British Columbia, and in the Rocky Mountains from Alberta to Colorado and the Black Hills of South Dakota; also in the northern Cascade and Olympic ranges of Washington. Map 8.

Representative specimens: Without locality, Franklin Expedition (GH, as *O. Lambertii β*, and as *O. Lambertii,* both ex herb. Hooker., presumably collected by Richardson in Canada). British Columbia. Similkameen River, *Macoun 70410* (GH, ND, NY). Deer Park, Lower Arrow Lake, *Macoun 5358* (ND, type of *Aragallus cervinus).* Alberta. Elbow River, *Macoun 18517* (ND, cotype of *Aragallus Macounii).* Mistaya River, near Mt. Murchison, *Hitchcock & Martin 7782* (NY, POM, WTC, WTU)*[12]. Upper Waterfowl Lake, Banff-Jasper Hwy., *A. & R. Nelson 3100* (GH, NY, WTU). Saskatchewan. Without locality, *Bourgeau in 1858* (GH, NY). 25 mi. w. of Touchwood, *Macoun & Herriott 70792* (G, ND, NY). Prince Albert, *Macoun 12535, 12540* (ND, cotypes of *Aragallus albertinus).* Manitoba. Mouth of Qu'Appelle River, *Macoun & Herriott 70795* (CAS, ND, NY). Washington. Olympic Mts., Clallam County, *A. D. Elmer 2532* (US, type of *Aragallus luteolus,* ND, NY, MINN, WTC). Olympic Mts., Jefferson County, *Flett 134* (WTC, type of *O. olympica).* Marmot Pass, Jefferson County, *J. W. Thompson 9932* (CAS, NY, POM, WTC, WTU). N.-w. of Riverside, Okanogan County, *St. John 7728* (WTC, type of *O. okanoganea).* Goat Mts., Pierce County, *O. D. Allen 245* (WTC, type of *O. Mazama,* CAS, NY, RB, WTU). Mt. Wow, Pierce County, *J. W. Thompson 12578* (CAS, NY, POM, WTC, WTU). Grouse Creek, Mt. Baker, Whatcom County, *St. John 5513* (WTC, type of *O. cascadensis).* Montana. Jocko River, Lake County, *Canby 91* (GH, lectotype of *O. monticola).* Craig, Lewis and Clark County, *Wilcox 378* (US, type of *Aragallus villosus,* NY)*. Cut Bank Creek, Glacier County, *G. N. Jones 5491* (GH, NY). Westby, Sheridan County, *Esther Larsen 10* (GH). Wyoming. Laramie Peak, Albany County, *A. Nelson 7523* (GH, NY, POM). South Dakota. Custer, Custer County, *Rydberg 636* (GH, NY), Colorado. Nelson, Jackson County, *Ripley & Barneby 9010* (CAS). Phantom Valley Ranch to Idaho Springs, Clear Creek County, *Mrs. Cantelow in 1942* (CAS).

The present variety is the plant currently passing in the literature as *O. gracilis* and, in small and varying degrees of correctness, as *O. monticola,* the small-flowered *Oxytropis* with numerous leaflets and whitish flowers common at middle altitudes in the northern Rocky Mountains, in the northern Cascades (where often called *O. luteola),* and on the plains of the Saskatchewan. It is variable especially in the amount and orientation of the pubescence, to some extent in the size of the flowers, and in other characters. When growing in deciduous woodland, open pine-forest, or in moist mountain parks, the plants are inclined to be sparingly pilose, with thin, green leaflets, and the stipules tend to be dorsally glabrous and sparsely, if at all, bristly-ciliate along the edges of the free blades. The plant of drier or more exposed sites is commonly silky-pilose, with smaller and thicker leaflets, and the stipules are at first, or permanently, pilose dorsally and ciliate. Passage between the silky and glabrescent states is established by many intermediate forms, and both may occur together (cf. *Johnson*

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[12] Asterisk indicates some geminate leaflets present.

158, from the Black Hills, NY), or in the same immediate region. Rydberg maintained the green state as *O. glabrata* (erroneously based on *O. campestris* var. *glabrata,* the type of which is apparently *O. Maydelliana),* an arbitrary segregate based on a single unstable character. Whatever the density of the vesture, the scapes may be appressed-pilose or bear some long and loosely ascending to divaricate hairs near the base and below the inflorescence, as in the isotypes of *O. gracilis,* or may even become copiously villous their whole length, as in the type of *Aragallus villosus.* The primary and secondary leaves are usually dissimilar in the size and shape of the leaflets, dimorphism being accentuated in the more xerophytic state. The leaflets are normally opposite or scattered, but paired and pseudo-verticillate leaflets are not uncommon. In some cases a single leaf may bear two leaflets attached at a point, while in others paired leaflets are numerous in some or nearly all the secondary leaves, a tendency especially marked in plants from the foothills of Alberta Rockies.

On the Northwest coast and in the Cascade Range the situation in var. *gracilis* becomes quite complicated. *Oxytropis luteola, O. olympica, O. cascadensis,* and *O. Mazama,* all of northern Washington, are not exactly alike. St. John separated *O. luteola* and *O. olympica* on the basis of differences in size of corolla and leaflets, and on the degree of pubescence in the stipules. but these characters are interchangeable in material from the Oympic Mountains, where both species are said to be endemic, and, as pointed out by G. N. Jones (Univ. Wash. Pub. Bot., 5: 189), the vesture of a stipule depends to some extent on its position in the year's cycle of growth, the inner or later ones which subtend the secondary leaves being commonly less hairy than those of the exterior primaries. Jones nevertheless maintained *O. olympica* on its supposedly narrower leaflets, smaller flowers, and denser, fewer-flowered racemes. Here again the characters stressed are by no means always coincident, and Jones's concept of both species is weakened by the fact that he cited as representative of each some specimens of the Olympic phase of *O. viscida.* The *Oxytropis* of the Olympics exhibits great variation in flower-size, but no greater than does var. *gracilis* in the type-region of the Black Hills, and the conclusion of Abrams (Ill. Fl. Pac. St., 2:611, fig. 2917, 1944) that there is but one species of *Oxytropis* in that range is accepted. *Oxytropis Mazama,* except for St. John's record from the Olympics endemic to Mt. Rainier, and *O. cascadensis* from Mt. Baker are almost exactly similar. The former was said to differ from the rest in its dorsally glabrous stipules, but a few scattered trichomes are to be seen in an isotype (WTU). St. John claimed that *O. cascadensis* could be distinguished from *O. luteola* and *O. olympica* by its smaller calyx (7–8 mm. long at anthesis) and fewer (18–21) leaflets. But in part of *Flett 803* (WTU), a plant from the Olympics referred to *O. olympica* by St. John himself, the fruiting calyx is only 6.5 mm. long; and the leaflets in plants from Mt. Baker may number 28 to the leaf. In general it can be said that the Cascadean populations are less densely pilose than those of the Olympics, and that they perhaps too closely approach in stature and leaflet-number the var. *Cusickii.* What was later to be taken as the type of *Aragallus luteolus* was early identified by Piper (Fl. Wash., 367) as *O. gracilis,* and those of *O. olympica* and *O. Mazama* as *O. monticola,* but he offered no contrasting characters between the species; in fact there seem to be none of significance.

The northwestern segregates so far noted are all montane plants of medium stature. In northern Washington and adjacent British Columbia, particularly along the Okanogan River, there occurs a robust lowland ally of *O. campestris,* described independently as *Aragallus cervinus* Greene and as *O. okanoganea* St. John, the last distinguished from its close relatives by densely pilose stipules and large leaflets. In the extreme state, with tall erect, often villous scapes, ample herbage and lax racemes of large flowers, this appears adequately distinct. However the peculiar habit may be combined with glabrescent stipules (cf. *Elmer 595,* from Mt. Chacpaca, NY), while we have from British Columbia a suite of forms in which densely pilose stipules are combined with gradually diminished stature (cf. *J. W. Thompson 45*, from Kamloops, CAS, NY, WTU) until at the end of the series one arrives back at a plant inseparable from the montane races of var. *gracilis.* Perhaps more striking than the characters of vesture and stature in *A. cervinus* is the frequent reduction in leaflet-number, a densely silky plant such as *Macoun 70411* (from Mt. Osoyoos, NY) having some mature leaves with no more than 13–15 leaflets, although others similar in facies (cf. *J. W. Thompson 36,* from Spence's Bridge, NY, WTU) bear up to 21 leaflets. Meanwhile in extreme northwestern Montana (cf. *Kirkwood 1190,* NY) the reduction of leaflets is combined with the large flower of *A. cervinus* and nearly glabrous stipules and herbage, a state uncomfortably reminiscent of the otherwise subalpine and small-flowered var. *Cusickii.* Toward the culmination of its line of development *A. cervinus* does assume an aspect not duplicated elsewhere in the range of var. *gracilis,* but the material intergradient in one way or another is so much more copious than that identifiable as the extreme form, that a definition of it seems impracticable at present. Both Rydberg and Dayton have reduced *A. cervinus* to *O. sericea* var. *spicata* (as *A. spicatus* and *O. Macounii* respectively), no doubt on account of its ample flowers with broad wings; but the type unquestionably belongs with the thin-podded, *O. campestris* series.

The var. *gracilis* has been known for well over a century, and has had a chequered nomenclatural history. The *O. campestris* of early authors was no doubt partly this variety, though it is now scarcely possible to unravel the fluctuating concepts of the species in American literature. It was first brought into the open and extricated from European *O. campestris* and from *O. Lambertii* in Gray's second revision (1884), where it received the name *O. monticola.* This species was based on six collections, not quite all conspecific, cited as follows: "Northern Rocky Mountains, viz., Wyoming and Montana, *Parry,* no. 87, *Canby;* Dakota, coll. *Jenney,* but in flower only. Rocky Mountains in British Possessions, *Bourgeau,* with fruit, *Lyall,* in flower only; and Spy Hill, *Macoun,* 1879, no. 107, in fruit." The plants of Canby, Bourgeau, Lyall and Macoun (all GH) are ochroleucous-flowered var. *gracilis;* the Jenney collection belongs to var. *dispar;* while *Parry 87* represents a rare state of *O. viscida* in which the bracts are dorsally pilose. The last has been annotated by C. L. Porter (GH) as type of *O. monticola,* doubtless because it was the first cited, and if this choice is accepted the name must fall into the synonymy of *O. viscida.* Gray, however, pointedly set off his new species from *O. viscida* and *O. leucantha,* defined as "pl. m. viscosa, saltem calyces," by the phrase "nec glandulosa nec viscida" and further emphasized the point that *O. monticola* was "like *O. viscida* Nutt., but neither glandular nor viscid." To proclaim typical of a species a specimen which so exactly contradicts the diagnosis and description is a fundamental misuse of the type-principle. The fact that Gray overlooked the glandular warts on the bracts, calyx, and legume of *Parry 87,* and cited it as belonging to *O. monticola,* cannot outweigh his repeated stress on the absence of viscidity. There can be no question as to what Gray had in mind as *O. monticola,* and the name, based if one must choose on *Canby 91* (GH, lectotype!), has obvious priority, in the specific category, over *O. gracilis.* But in order to avoid the possibility of confusion it has seemed best to take up, in the varietal rank, the later epithet *gracilis,* as to whose application no doubt is likely to arise.

Partly owing to the mixed nature of Gray's material, *O. monticola* has been widely misunderstood. Rydberg early recognized the identity of *Parry 87,* and cited *O. monticola* (Cont. U. S. Nat. Herb., 3:493) in the synonymy of *Spiesia viscida.* At various times Nelson applied the name to specimens of *O. Lagopus* var. *atropurpurea, O. Besseyi* var. *Besseyi,* and *O. Besseyi* var. *ventosa.* In the Flora of Montana Rydberg transferred the name to white-flowered *O. campestris* var. *Cusickii* and later (Fl. Rocky Mts.), in the key defined *O. monticola* as an eglandular plant with small purple flowers, supposedly confined to Wyoming and Colorado. Nothing is known from this area which agrees with Rydberg's concept at this date and, significantly, there is not one sheet at New York Botanical Garden labelled *O. monticola* in Rydberg's hand; clearly *O. monticola* of this reference was a chimera, compounded of the small purple flower of Parry's plant and the eglandular herbage described by Gray. In his most recent paper on *Oxytropis* (Univ. Wyo. Pub. Bot., 1: 109–121, 1926) Nelson made no mention of *O. monticola* either among the "common Locos" or the "troublesome and doubtful species," even though it should have been by original definition a plant of the range under consideration and one of the earliest names applied to a western species. Lately Tidestrom has substituted for *O. monticola* the name *Astragalus Grayanus* and (loc. cit.) there conceives the species as purple-flowered, with "leaflets 7–11," ranging southward to so remote and improbable a region as Flagstaff, Arizona[13]; in its many vicissitudes *O. monticola* was never so carelessly interpreted.

Spontaneous hybrids involving var. *gracilis* are discussed under the headings of *O. viscida* and *O. sericea.*

15c. **Oxytropis campestris** (L.) DC. var. **Cusickii** (Greenm.) Barneby

Oxytropis campestris (L.) DC. var. *Cusickii* (Greenm.) Barneby, Leafl. West Bot., 5:111. 1951 (Jan.); R. J. Davis, Madroño, 11:144. 1951 (Jul.). *O. Cusickii* Greenm., Erythea, 7:116. 1899.

Aragallus alpicola Rydb., Mem. N. Y. Bot. Gard., 1:252. 1900. *Oxytropis alpicola* (Rydb.) Jones, Mont. Bot. Notes, 37. 1910; non Turcz. (1842). *O. Rydbergii* A. Nels., Univ. Wyo. Pub. Bot., 1:117. 1926. *Astragalus alpicola* (Rydb.) Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937. *Oxytropis campestris var. Rydbergii* (A. Nels.) R. J. Davis, Madroño, 11:144. 1951.

Oxytropis Paysoniana A. Nels., Univ. Wyo. Pub. Bot., 1:119. 1926.

Similar to var. *gracilis* but usually lower, densely or thinly pilose throughout; stipules glabrous or sparingly pilose toward the base, the free blades ciliate or eciliate; leaves 1.5–12 cm. long, erect or spreading, with 7–15 (17) leaflets 3–15 (23) mm. long; scapes erect, arcuate-ascending or prostrate, 2.5–15 cm. long, glabrate, appressed-pilose or rarely villous-pilose toward the base or even throughout; racemes 3–15-flowered, little elongating, the axis 0.5–3 (6) cm. long in fruit; bracts pilose dorsally or at length glabrescent; calyx 7–9 (10) mm. long, the tube fuscous-strigose or variously pilose-hirsute with longer and looser pale or dark hairs, the teeth (1.5) 2–3 mm. long; petals ochroluecous, concolorous, or the keel perhaps sometimes maculate; banner 14–18 (20) mm. long; keel 11–12.5 mm. long. *Types* collected by W. C. Cusick, in "1891" (or 1886 according to the label) and 1898, on alpine summits of the Wallowa Mountains, eastern Oregon; Wallowa Mts., *Cusick 1365* (GH), *2095* (GH, ND, UC, US)!

Distribution: Rock-slides, stony ridges and alpine or subalpine meadows, chiefly above timberline, between 7,000 and 11,000 ft. altitude, from northern Colorado northward on and near the Continental Divide to Alberta and British Columbia, westward to Idaho, the Wallowa Mts., Oregon, and the Wenatchee Mts. and Okanogan County, Washington. Map 8.

Representative specimens: British Columbia. Carbonate Draw, *C.H. Shaw 345* (NY, US). Alberta. Mt. Paget, Rocky Mt. Park, *Macoun 65075* (GH, NY). Upper Carthew Lake, *Hitchcock & Martin 7910* (POM, WTU).

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[13] The only oxytropis known definitely from Flagstaff is *O. Lambertii* var. *Bigelovii,* but Tidestrom's description suggests the more robust phase of *O. oreophila,* which seems to find its southern limit on the Kaibab north of Grand Canyon.

Washington. Table Mt., Kittitas County, *J. W. Thompson 9806* (CAS, NY, POM, WTU). Rocky Mt., trail to Tiffany Lake Pass, *Fiker 379* (WTC). Oregon. Lostine Canyon, Wallowa County, *Peck 17880* (NY, WTU). Idaho. Mackay, Custer County, *Nelson & Macbride 1464* (NY, POM). Montana. East Pintlar Peak, Anaconda Range, Beaverhead County, *Hitchcock & Muhlick 12861* (CAS, WTC). Sexton Glacier, Glacier Nat. Park, *Standley 17271* (US). Old Hollowtop near Pony, *Rydberg & Bessey 2503* (NY, type of *Aragallus alpicola*, GH, ND). Wyoming. Big Horn Mts., Sheridan County, *Tweedy 2376* (NY). Summit of Piney Mt., Sublette County, *E. & L. Payson 2700* (NY, US, isotypes of *O. Paysoniana)*. Powder River Pass, Washakie County, *M. Ownbey 813* (IDS, WTC). Utah. Goodman's Ranch, Bear River, Summit County, *E. & L. Payson 4868* (POM). Colorado. Breckenridge, Summit County, *K. K. Mackenzie 118* (NY).

The var. *Cusickii* is intimately related to var. *gracilis,* differing principally in the relatively few leaflets to the developed leaves. The two are nearly identical in corolla and pod, varying in the size of these organs, as well as in the density of vesture, to about the same degree. The scapes may be strictly erect, arcuate-ascending, or in exposed sites prostrate, the last state corresponding with *Aragallus alpicola.* During the preliminary studies, an attempt was made to maintain the latter as a distinct variety of *O. campestris,* and a number of herbarium sheets were so labelled. The condensed and depressed alpine state appears to have a more northern range, from western Montana northward, but the more rigorous conditions could as well account for the difference in stature, low scapes, and few-flowered racemes, and there are no supporting characters. The keel of *A. alpicola* was originally described as "tipped with purple," but no trace of color remains on the type, and the flowers of all the material seen by the writer appear to have been concolorous when fresh. Rydberg, however, saw the fresh flower, so the purple spot may occur, though it is certainly fugacious.

Oxytropis Cusickii and *O. Paysoniana* are unquestionably conspecific. In the type-collections of each the calyx may be strigose with dark hairs and pale-hirsutulous as well, or the longer looser hairs may be altogether deficient. Nelson made no remark of a diagnostic nature when describing *O. Paysoniana,* merely stating that the specimens before him had been distributed as *O. alpicola* and *A. luteolus;* probably he did not know authentic *O. Cusickii,* at least at that time.

Up to the present *O. Cusickii* (often erroneously attributed to E. L. Greene) has been thought to be confined to the Wallowa Mountains. Blankinship, it is true, recorded (Mont. Agric. Sci. Stud., 1:80, 1905) a collection from Montana, but it was not admitted by Rydberg to the Rocky Mountain Flora (1917). Recently Abrams has referred to it some plants of the Cascade Range in northern Washington, but these seem to be nearer to var. *gracilis.* As here defined, var. *Cusickii* replaces var. *gracilis* in the mountains of Idaho, western Wyoming, and Montana, north of which it is separated from var. *gracilis* by altitude and life-zone. At the latitude of Banff var. *gracilis*, which is montane or submontane southward, is down in the valleys, while var. *Cusickii* occupies the summit screes.

15d. **Oxytropis campestris** (L.) DC. var. **dispar** (A. Nels.) Barneby

Oxytropis campestris (L.) DC. var. *dispar* (A. Nels.) Barneby, Leafl. West. Bot., 5:111. 1951. *Aragallus dispar* A. Nels., Erythea, 7:61. 1899, sensu stricto. *Oxytropis dispar* (A. Nels.) K. Schum., Just's Jahresb., 27^1:496. 1901; Cockerell, Torreya, 18:180. 1918 (as "comb. nov.").

Densely and permanently silky-pilose, the stipules usually concealed by the vesture; leaves strongly dimorphic, the primaries short, with short, crowded ovate leaflets, the upper with 19–25 linear-lanceolate or narrowly oblong leaflets up to 2 cm. long; scapes 7–19 cm. long; racemes 8–15-flowered, the axis becoming 3–8 cm. long in fruit; calyx 8–9 mm. long, the tube 6–6.5 mm., the teeth 2–2.5 mm. long; petals purple, blue, pink, white, or ochroleucous, the banner 17–19 mm. long, 6–8 mm. wide; wings 14–16 mm. long, the blades dilated upward and 4.5–6 mm. wide near apex; keel 12–13 mm. long; pod of firmer texture than in related forms. *Type* collected by Mrs. C. R. Cook, in 1896, at Dickinson, North Dakota; Dickinson, Stark County, *Mrs. Cook* (WYO)!

Distribution: Prairies or brushy places along ravines, apparently confined to North Dakota. Map 8.

Specimens examined: "Dakota," *Jenney* (GH). Bismark, Burleigh County, *Sadie Lauterman in 1891* (OB). Butte, Benson County, *Lunell in 1904, 1905, 1906, 1907 and 1908* (all NY). Sentinel Butte, Golden Valley County, *Hanson in 1936* (UC). Kulm, Lamoure County, *Brenkle in 1906* (NY). Washburn, McLean County, *Bergman 1601* (OB). Ward County, *Lunell in 1909* (NY). Williston, Williams County, *O. A. Stevens in 1918* (NY).

This odd prairie race is closely related to var. *gracilis*, from which it is distinguished only by the polychrome coloration of the flowers and by the somewhat firmer texture of the pod. The dimorphism of the leaves, to which the epithet *dispar* refers, has been overstressed, for it appears occasionally in equally extreme form in undoubted races of var. *gracilis*. It may well be that var. *dispar* originated as a fertile hybrid between white-flowered var. *gracilis* and purple-flowered *O. Lambertii*, common in the same region. Lunell's suite of specimens from Butte is suggestive here, for the collector noted (NY): ". . . this plant has about 15 different shades of the flowers, from white, cream-color, light blue, dark blue and dark purple; these colors mixed present the most gorgeous aspect . . ." Similar polychrome populations, believed to be derived from crossing of *O. sericea* and *O. Lambertii*, are noted elsewhere in this paper. Morphologically var. *dispar* is somewhat intermediate, resembling var. *gracilis* in number and disposition of the leaflets and in the basifixed pubescence, while the more nearly coriaceous pod and broad wing-petals could have been inherited from *O. Lambertii.* Other suspected hybrids in the genus occur only where the parents grow in immediate association. Here the situation is different, for only one parent, *O. Lambertii,* is present. However, var. *gracilis,* although chiefly montane in the latitude of North Dakota, does come out onto the plains of northeastern Montana, the station at Westby, Sheridan County, being closely adjacent to the westernmost locality of var. *dispar* in Williams County, N. D. Whatever its history, var. *dispar* seems to be self-perpetuating at the present time. During the preliminary studies, most of the material seen in herbaria was annotated as var. *gracilis,* of which it was thought to be a minor variant, but as additional collections have come to light and its natural area has become better defined, it seems proper to maintain it as a named entity.

The name *dispar* has been generally applied, by Nelson himself and by Rydberg, to a form of *O. Lambertii* with dimorphic leaves, further discussed under the head of that species. However, in the type of var. *dispar,* which consists of two roots, one bearing ochroleucous, the other purple flowers (thus confirming its identity), the pubescence is entirely basifixed.

15e. **Oxytropis campestris** (L.) DC. var. **columbiana** (St. John) Barneby

Oxytropis campestris (L.) DC. var. *columbiana* (St. John) Barneby, Leafl. West Bot., 5:111. 1951. *O. columbiana* St. John, Proc. Biol. Soc. Wash., 41:100. 1928.

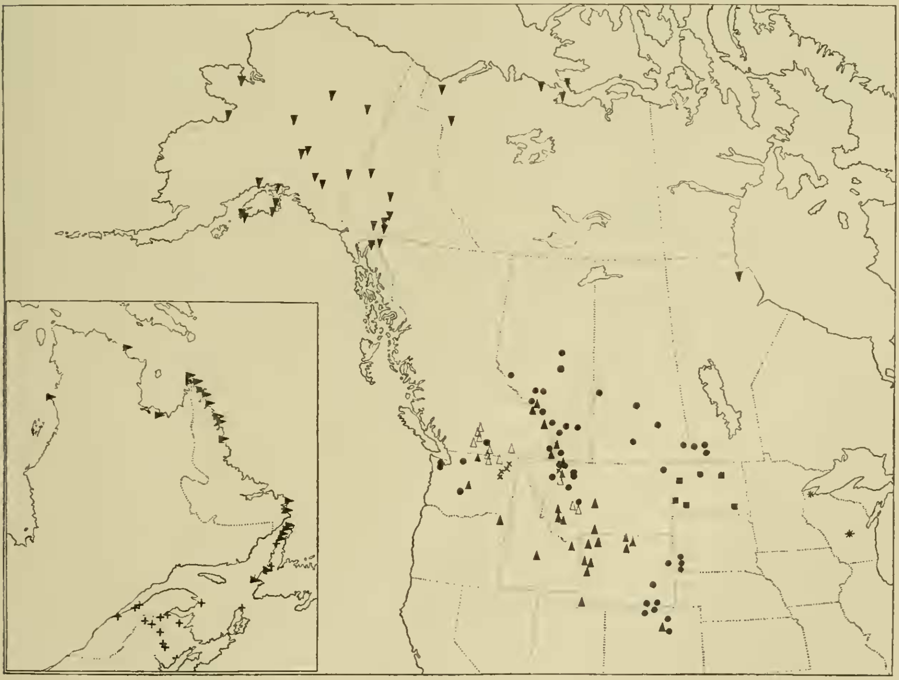
Robust, tufted on a heavy taproot, the herbage silky-pilose, greenish or canescent; stipules prevailingly pilose dorsally, rarely glabrescent, the deltoid to caudate-acuminate free blades 6–13 mm. long; leaves (5) 8–17 cm. long, with 11–17 broadly lance-oblong to narrowly elliptic leaflets 9–30 mm. long; scapes erect, (1) 2–3 dm. long, commonly bearing some spreading hairs at base; racemes (6) 10–28-flowered, at first dense and oblong, the axis becoming 2–10 cm. long in fruit; calyx loosely silky-pilose, often with many dark hairs, 7.5–10 mm. long, the tube 5–6.5 mm., the teeth (2) 2.5–4 mm. long; corolla white, the banner veined and the keel maculate with purplish-blue; banner oblanceolate-obovate, 15.5–20 mm. long, about 6 mm. wide; wings 13–18 mm. long, the obliquely oblong blades 9–11.5 mm. long, 3–4 mm. wide; keel 12–17 mm. long. *Type* collected by Harold St. John, in 1924, on the gravelly beach of the Columbia River near Marcus, Stevens County, Washington; *St. John 6482* (WTC, GH)!

Distribution: Gravel-bars and stony river- or lake-shores, between 1,200 and 3,000 ft. altitude, along the Columbia above the mouth of the Spokane in northeastern Washington, and about Flathead Lake in northwestern Montana. Map 8.

Representative specimens: Washington. Inchelium, Ferry County, *Rogers 529* (CAS, NY, POM, WTC, WTU). Below Gifford, Stevens County, *Rogers 520* (CAS, NY, POM, IDS, WTC). Montana. White Swan Bay, Flathead Lake, *Reed & Barkley 19* (NY, US, WTC).

The var. *columbiana* differs absolutely from var. *gracilis* only in the color of the flowers, in other respects closely simulating the robust, lowland form of the latter which has been described as *Aragallus cervinus* (cf. discussion of var. *gracilis)*. There is a tendency for the calyx-teeth to be longer, but complete intergradation is found in this direction. From var. *Cusickii,* with which it has relatively few (11–17) leaflets in common, it differs in its greater stature, more numerous flowers, purple keel, and riparian habitat. In essential characters of flower, fruit, and habit the variety is so nearly identical with other races of *O. campestris* that it can scarcely be considered as more than a minor derivative of the complex.

The direction and extent of variability in var. *columbiana* is significant in evaluating criteria used in the species as a whole. Assuming that the



Map 8. Range of *Oxytropis campestris* in America: var. *varians* ▼; var. *gracilis* ●; var. *gracilis,* the "*cervinus*" form △; var. *Cusickii* ▲; var. *dispar* ■; var. *columbiana* ✕; var. *terrae-novae* ▶; var. *johannensis* +; var. *chartacea* ✤.

seven flowering collections known from the banks of the Columbia in Ferry and Stevens counties, all with white banner and maculate keel, are conspecific in the narrowest sense, the race so represented varies to a surprising degree in density of vesture, size of flower, and other characters. The stipules are most commonly pilose throughout, but the free blades may become glabrate, or the whole dorsal face (cf. *Rogers 414,* from Northport, NY) glabrous except for a few scattered hairs along the midrib. The scapes, prevailingly ascending-pilose or even hirsute at base, may be appressed-pilose throughout, and the banner varies from 15.5 to 20 mm. in length, the keel from 12 to 17 mm. Once such latitude has been admitted to a race of limited distribution and somewhat specialized habitat, it becomes easy to appreciate the slight value of these same criteria in *O. campestris* as a whole.

15f. **Oxytropis campestris** (L.) DC. var. **terrae-novae** (Fern.) Barneby

Oxytropis campestris (L.) DC. var. *terrae-novae* (Fern.), comb. nov. *O. terrae-novae* Fern., Rhodora, 30:147, Pl. 174. 1928.

Oxytropis uralensis γ minor Hook., Fl. Bor.-Amer., 1:146. 1834, pro parte, quoad pl. labrador.

Low, loosely cespitose, the slender divisions of the caudex sometimes elongating and up to 5 cm. long, the herbage green, sparingly pilose with appressed and a few ascending hairs, exceptionally silky-pilose to maturity; stipules glabrous or nearly so dorsally, the free blades deltoid to lance-acuminate, 2–7 mm. long, eciliate or sparsely bristly at apex; leaves (2) 3–10 (13) cm. long, with 11–23 (27) distant, lanceolate to elliptic, rarely ovate, acute or acutish leaflets 2–10 mm. long; scapes arcuate-ascending 3–12 (16) cm. long; racemes (3) 5–9-flowered, subcapitate, the axis 3–15 mm. long in fruit; bracts sparingly pilose to quite glabrous dorsally; calyx pilose with fuscous and some longer pale hairs, 5–7 mm. long, the tube 4.5–6 mm., the teeth 0.5–1.5 mm. long; petals purple, drying violet; banner 11–18 mm. long, 4.5–6 mm. wide; wings 10–15 mm. long, the oblong-obovate blades not much dilated upward, 3–4.5 mm. wide near the obliquely truncate-emarginate apex; keel 9–13 mm. long, the appendage 1 mm. long or reduced to a minute boss. *Type* collected by M. L. Fernald and colleagues, in 1925, on St. John Island, Newfoundland; *Fernald et al. 28615* (GH)!

Distribution: Turfy or peaty barrens near the coast, Ungava Peninsula, Labrador, and west coast of Newfoundland, south to about latitude 48° N.; reported from the Mackenzie Mts., N. W. T. Map 8.

Representative specimens: Quebec. Port Harrison, e. coast of Hudson Bay, *Malte 127018* (NY). Wakeham Bay, Hudson Strait, *Malte 126950* (NY). Labrador. Rama, *Stecker 364* (NY, US). Newfoundland. Table Mt., Port-au-Port Bay, *Fernald & Wiegand 3635* (GH, NY).

Especially in general habit, var. *terrae-novae* closely resembles European

O. campestris, and, as brought out by Fernald, the bright purple flower and shorter calyx with (nearly always) shorter teeth, seem the most significant differences. Quite recently Porsild (Sargentia, 4: 52) has reported from Komaktorvik Fjord, Labrador, a specimen of supposedly authentic *O. campestris;* this record seems rather unlikely and should be rechecked.

It is interesting that var. *terrae-novae,* which passed until 1928 as *O. uralensis, O. campestris,* or some variety of one or the other, was probably the first member of the genus to be found in the New World. As early as 1800 we find mention in Pallas of a plant from Labrador, communicated by Schreber, which almost certainly must belong here (cf. *Astragalus* sp., in Pall., Astrag., 64, in nota sub *A. baicalensi),* as also the Labrador collection cited by Hooker (l. c.) as *O. uralensis* var. *minor,* and by Schlechtendal (Linnaea, 10: 99, 1835) as *O. uralensis β.*

In the absence of corresponding material it has not been possible to verify the most interesting report (Porsild, Nat. Mus. Canad. Bull., 101: 24, 1945; Raup, Sargentia, 6: 208, 1947) of var. *terrae-novae* from the east slope of the Mackenzie-Yukon divide in the Northwest Territories, where it is said to be fairly common on "limestone barrens," a habitat similar to that often favored by the variety on the west coast of Newfoundland. The occurrence of var. *terrae-novae* in the Northwest brings up the possibility that *O. uralensis* var. *minor* Hook., described from "dry hills and prairies in the Rocky Mountains" (with an additional report from Labrador) may be the earliest name for the variety. See further, under Excluded Species, below.

15g. **Oxytropis campestris** (L.) DC. var. **johannensis** Fern.

Oxytropis campestris (L.) DC. var. *johannensis* Fern., Rhodora, 1:88. 1899. *Aragallus campestris* var. *johannensis* "Fern." ex Macoun, Ottawa Nat., 13:163. 1899, nomen. *A. johannensis* (Fern.) A Hell., Cat. N. Amer. Pl., Ed. 2:7. 1900. *Oxytropis johannensis* (Fern.) Fern., Rhodora, 30:145, Pl. 173. 1928.

Oxytropis Lambertii δ ? T. & G., Fl. N. Amer., 1:338. 1938.

Oxytropis campestris var. *americana* Brunet, "Cat. Pl. Canad., 39. 1865," nom. nud., fide Fern., 1928, l. c.

Oxytropis johannensis fma. *bicensis* Vict. & Rouss., Cont. Inst. Bot. Univ. Montréal, 36:32. 1940.

Permanently silky-pilose with subappressed hairs or more often becoming green and glabrate; stipules 1–3 cm. long, glabrous to sparingly pilose dorsally, the free blades ovate-acuminate to lance-caudate, (3) 5–12 (18) mm. long; scapes erect or rarely ascending, (4) 8–36 cm. long, appressed-pilose or glabrate; racemes 7–12 (14)-flowered, oblong or clavate in early anthesis, the axis elongating and 1.5–9 (11) cm. (averaging 4 cm.) long in fruit; calyx silky-pilose with pale, often mixed with short fuscous hairs, (6) 6.5–8 mm. long, the tube 5–6 mm., the lanceolate to narrowly deltoid teeth (1) 1.5–3 mm. long; petals, except in occasional albinos, purple; banner 12–18.5 mm. long, 6–8.5 mm. wide; wings 13–15 mm. long, the blades 8–11 mm. long, slightly dilated upward and 3.5–5.5 mm. wide near the shallowly emarginate apex; keel 10–13 mm. long, the usually straight appendage less than 1 mm. long. *Type* collected by M. L. Fernald, in 1898, on beaches of St. John River, Fort Kent, Aroostook County, Maine; *Fernald 2289* (GH, US)!

Distribution: Rock-ledges, islands, and gravel-bars along rivers of northern Maine, New Brunswick, and Gaspé Peninsula; along the south shore of St. Lawrence River up to Ile d'Orleans; and on cliffs, headlands, and coastal barrens from St. Paul Island, Nova Scotia, to the southwest coast of Newfoundland. Map 8.

Representative specimens: Newfoundland. Ha-ha Point, Ha-ha Bay, *Fernald & Long 28603* (GH, NY). Nova Scotia. St. Paul I., *Perry & Roscoe 266* (NY, US). Quebec. Ile Bonaventure, *Marie-Victorin & al. 17251* (GH, NY). Near Quebec, *Mrs. Percival* (NY, the *O. Lambertii* δ? of T. & G.). Mont Bic, Rimouski County, *Rousseau 31031* (US). Restigouche River, below Patapédia, *Rousseau & Bonin 32238* (OB). New Brunswick. St. John River, e. of Clair, *Fernald & Pease 25168* (GH, NY). Maine. Fort Kent, Aroostook County, *K. K. Mackenzie 3406* (NY), *3415* (NY, flowers white).

Oxytropis johannensis falls well within the extended concept of *O. campestris* adopted in this paper, being structurally indistinguishable in flower, stipule, and legume from other races of the species, and it is therefore possible to take up the trinomial under which it was originally described, and which admirably expresses its affinities. The exactly typical form, from watercourses in the interior, is a coarse plant with elongate scapes and ample foliage but examples from the coast are more condensed, and a collection from Cow Head, Newfoundland *(Fernald & Wiegand 2633,* GH, NY), includes an individual as dwarf in stature as the prevailing state of var. *terrae-novae.* Similarly a specimen from Cape St. George, Newfoundland *(Mackenzie & Griscom 11054,* NY), with the technical characters of var. *terrae-novae,* is densely silky-pilose at maturity, a state not uncommon in var. *johannensis* but elsewhere unknown in var. *terrae-novae.* It is possible that the two varieties run together in southwestern Newfoundland, but there is no difficulty in separating material from north and south of this area. Where the criteria stressed by Fernald (e. g. length of stipule-blades, of leaflets, raceme or bracts) fail, as they sometimes separately do, to distinguish the two, the short calyx-teeth have been taken as the principal diagnostic character of var. *terrae-novae.*

The reader is referred to Fernald's excellent account in Rhodora (l. c. 1928) for detailed discussion of the history of var. *johannensis* and for full citation of material.

15h. **Oxytropis campestris** (L.) DC. var. **chartacea** (Fassett) Barneby

Oxytropis campestris (L.) DC. var. *chartacea* (Fassett), comb. nov. *O. chartacea* Fassett, Rhodora, 38:95. 1936.

Similar in nearly every way to var. *johannensis,* but the pod shorter, 8–15 (as opposed to 14–27) mm. long, and the vesture of the whole plant more copious and looser, the stipules permanently pilose. *Type* collected by N. C. Fassett, in 1935, on the sandy shore of "Lake Huron," Plainfield, Wisconsin; Plainfield, Waushara County, *Fassett 16704* (GH, NY, OB, isotypes)!

Distribution: Sandy lake-shores, central and northwestern Wisconsin. Map 8.

Representative specimens: Wisconsin. Pigeon Lake, Drummond, Bayfield County, *Fassett 16478* (N.Y.) Plainfield Lake, Waushara County, *Wadmond & Fassett 17386* (WTC), *Fassett 17385* (OB).

When better known var. *chartacea* may well be referred to var. *johannensis.* It is very poorly characterized.

16. **Oxytropis sericea** Nutt.

Cespitose, the numerous crowns clustered on a pluricipital caudex, the short branches of which are clothed with marcescent stipules and leaf-bases; herbage silky-pilose throughout with basifixed hairs, canescent (becoming tawny when dried) or rarely greenish; stipules pale, at first membranous and connate opposite the petiole, early ruptured and at length becoming chartaceous, the whole more or less pilose dorsally, sometimes subtomentose, 7–28 mm. long, the free blades deltoid to deltoid-acuminate, (2) 5–12 mm. long, hispid-ciliate, often glabrate in age; leaves commonly dimorphic 3.5–30 cm. long, with (9) 11–19 (25) opposite or somewhat scattered, ovate, ovate-oblong, elliptic or lanceolate, obtuse or acute leaflets (0.7) 1–4 cm. long, 2–10 mm. wide, laxly disposed along a rachis about twice as long as the appressed- or ascending-pilose petiole; scapes erect or ascending, 7–30 cm. long, commonly stout, equalling or often surpassing the foliage, pilose with appressed or some loosely ascending hairs; racemes 6–27-flowered, dense at first anthesis and oblong or subcapitate, either remaining so or more often becoming loose thereafter, the axis 1.5–18 cm. long in fruit; bracts lanceolate, herbaceous, 3–15 mm. long, pilose and sometimes also hirsute dorsally; pedicels at anthesis short, becoming 1–3 mm. long in fruit, not joined to the axis and hence usually long-persistent; calyx cylindro-campanulate, early ruptured, (6) 8–12.5 mm. long, the unequal teeth ¼–½ the length of the tube, the whole variously pubescent with light and dark hairs, either strigose, appressed-pilose, or hirsute with spreading and ascending hairs; petals white, ochroleucous, lemon-yellow (with or without a purple spot on the keel) or more rarely lilac-tinged or even purple throughout; banner 15–26 mm. long, the broad claw abruptly expanded beyond the calyx-tube into an oblong-obovate, deeply emarginate blade 8–12 mm. wide; wings 15–21 mm. long, the blades (including the auricle about 2 mm.) 9–13 mm. long, obliquely dilated upward and (4) 5–8 mm. wide near the emarginate apex; keel 13–19 mm. long, the blades (including the straight or recurved appendage 1–2 mm.) 7–11 mm. long; pod erect, sessile, the body narrowly oblong or ovoid-oblong, 1–2.5 cm. long, (3) 4–7.5 mm. in diameter, more or less obcompressed and sulcate ventrally, passing into a short, straight or somewhat divergent acuminate beak, the valves fleshy when fresh, becoming coriaceous or almost woody and rigid, densely silky-strigose or -pilosulous with short light or dark hairs, rarely subtomentose, or glabrate in age, the ventral suture produced inward as a complete or nearly complete false septum 1–2.5 mm. wide; seeds numerous, brown, 2–2.5 mm. long.

Oxytropis sericea is our only species in which basifixed vesture, coriaceous exserted pod, and white to pale yellow (occasionally purple) flowers are combined, but at one point or another it approaches and is difficult to separate, at least at first sight, from its near relatives. An occasional white-flowered form of *O. Lambertii* or, when only fruit is present, an exceptionally silky phase of that species simulate *O. sericea* closely, while the occasional purple-flowered individuals of *O. sericea* resemble *O. Lambertii* var. *Bigelovii.* But the presence of dolabriform hairs readily distinguishes *O. Lambertii* in all doubtful cases. With *O. campestris* var. *gracilis* there is no such convenient character. Although the flower is here usually smaller than that of *O. sericea,* the two overlap in this respect, and the texture of the pod sometimes becomes the only positive criterion yet discovered. Nevertheless, in spite of hybrids involving *O. sericea* and the other two which tend, especially in the herbarium, to cloud the issue, the cleavage between the three species is usually marked.

The species is quite variable, and an attempt was made during the studies leading to the present account to define several varieties; and two unpublished trinomials were freely used in annotating specimens. The first of these, based on *Aragallus pinetorum veganus* Ckll. was early abandoned. The type of this, from above timberline in the mountains of northern New Mexico, is a dwarf but robust plant with ample white flowers, loose vesture, and exceptionally long calyx-teeth. Similar forms had been seen from great altitudes in the Rocky Mountains as far north as Montana and Idaho, and seemed to represent a subalpine race which could and ought to be set apart. The long calyx-teeth, which at first offered a promising character, eventually proved fallacious, being correlated neither with alpine habitat nor with dwarf stature. In this respect a series of specimens collected by Rydberg and Vreeland in southern Huerfano County, Colorado, is instructive. These are closely similar in minor details of stipule, pubescence, calyx, and corolla, so much so that it is impossible to take them for anything but conspecific in the narrowest sense. A plant from 3000 meters on Iron Mountain (their *No. 6003,* NY) is dwarf and condensed, with short racemes barely emerging from the foliage, and is in everything an excellent match for the type of var. *veganus.* A second collection, from near La Veta at 2100 meters *(No. 6005,* NY) is a giant and ample thing with loose and elongated raceme far exserted on stout scapes. Yet another, also from near La Veta, *(No. 1004,* NY) is intermediate in development. Moreover several collections from subalpine levels with short calyx-teeth are now known, so that it becomes impossible to draw a line between typical *O. sericea* and var. *veganus.*

Quite polymorphic as to stature, color of flower, color and orientation of the vesture, and other characters, *O. sericea* is composed of many small races, several of which have received names from time to time. The variable factors are combined in many ways and with so little appearance of having achieved stability within a natural range that there seems to be no truly practical way of maintaining any of the possible segregates, beyond recognizing them as minor variants. Disregarding occasional aberrant or unusual plants, it is possible nevertheless to make out a fairly definite progression from the large plant of the southern prairies and the foothills of New Mexico *(Aragallus pinetorum)* with loose raceme of white flowers and maculate keel northward to a more compact state with immaculate, lemon-yellow and prevailingly smaller flowers in the Alberta Rockies *(Aragallus spicatus* or *A. Macounii).* The extreme conditions are readily recognizable, so that it has seemed best, in spite of complete intergradation, to accept a northern var. *spicata.* The following key does not pretend to take into account the many doubtful forms, especially prevalent in Montana, which combine some characters of each variety.

Key to the Varieties of O. sericea

1. Petals white, ochroleucous or pale yellow, the keel often maculate with purple at apex 2

— Petals (white or yellowish) variously tinged with lilac, rose, or purple, sometimes bright purple throughout; hybrid forms of *O. sericea* with more or less genetic infection from *O. Lambertii,* or perhaps other species; cf. discussion below.

2. Corolla white or rarely ochroleucous, the keel purple-tipped; raceme nearly always elongate, at least in fruit; s. Montana and South Dakota southward, mostly at middle altitudes in the mountains, or on the plains, to n.-e. Nevada, s. Utah, New Mexico, and Oklahoma, occasionally high montane to the south .... 16a. var. *sericea*

— Corolla pale yellow throughout, the keel concolorous; raceme tending to be short and compact; n. Wyoming and centr. Idaho to British Columbia and Manitoba, mostly montane toward its southern limit .... 16b. var. *spicata*

16a. **Oxytropis sericea** Nutt. var. **sericea**

Oxytropis sericea Nutt. ex T. & G., Fl. N. Amer., 1:39. 1838. *O. Lambertii* var. *sericea* (Nutt.) Gray, Proc. Amer. Acad., 20:7. 1884. *Spiesia Lambertii* var. *sericea* (Nutt.) Rydb., Fl. Neb., 21:43, Pl. XI, fig. 107–109. 1895. *Aragallus sericeus* (Nutt.) Greene, Pittonia, 3:212. 1897. *A. Lambertii* var. *sericeus* (Nutt.) A. Nels., Erythea, 7:62. 1899, quoad. nom. (Non *Oxytropis sericea* (Lamk.) Simonkai, 1886).

Oxytropis Lambertii var. *ochroleuca* A. Nels., Bull. Wyo. Exper. Sta., 28:98. 1896. *Aragallus albiflorus* A. Nels., Erythea, 7:62. 1899. *Astragalus albiflorus* (A. Nels.) Gand., Bull. Soc. Bot. France, 48:xiv. 1901; Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937 (as "comb. nov."). *Oxytropis albiflora* (A. Nels.) K. Schum., Just's Jahresb., 27^{1}:496. 1901 (non *O. albiflora* Bge., 1874). *Aragallus saximontanus* A. Nels., Erythea, 7:190. 1899. *Oxytropis saximontana* (A. Nels.) A. Nels., Univ. Wyo. Pub. Bot., 1:113. 1926. *Astragalus saximontanus* (A. Nels.) Tidestr., Tidestr. & Kitt., Fl. Ariz. & New Mex., 216. 1941.

Aragallus albiflorus var. *condensatus* A. Nels., Erythea, 7:62. 1899. *A. saximontanus* var. *condensatus* (A. Nels.) A. Nels., op. cit., 190. 1900. *Oxytropis condensata* (A. Nels.) A. Nels., Univ. Wyo. Pub. Bot., 1:115 1926.

Oxytropis Lambertii "variety *lilacina*" Ckll., West. Amer. Sci., 5:11. 1888, nom. subnud.

Aragallus pinetorum A. Hell., Bull. Torr. Club, 26:548. 1899. *Oxytropis pinetorum* (A. Hell.) K. Schum., Just's Jahresb., 27^{1}:496. 1901.

Aragallus pinetorum veganus Ckll., Torreya, 2:155. 1902. *A. veganus* (Ckll.) Woot. & Standl., Cont. U. S. Nat. Herb., 16:136. 1913. *Oxytropis vegana* (Ckll.) Woot. & Standl., op. cit., 19:371. 1915.

Aragallus majusculus Greene, Proc. Biol. Soc. Wash., 18:12. 1905.

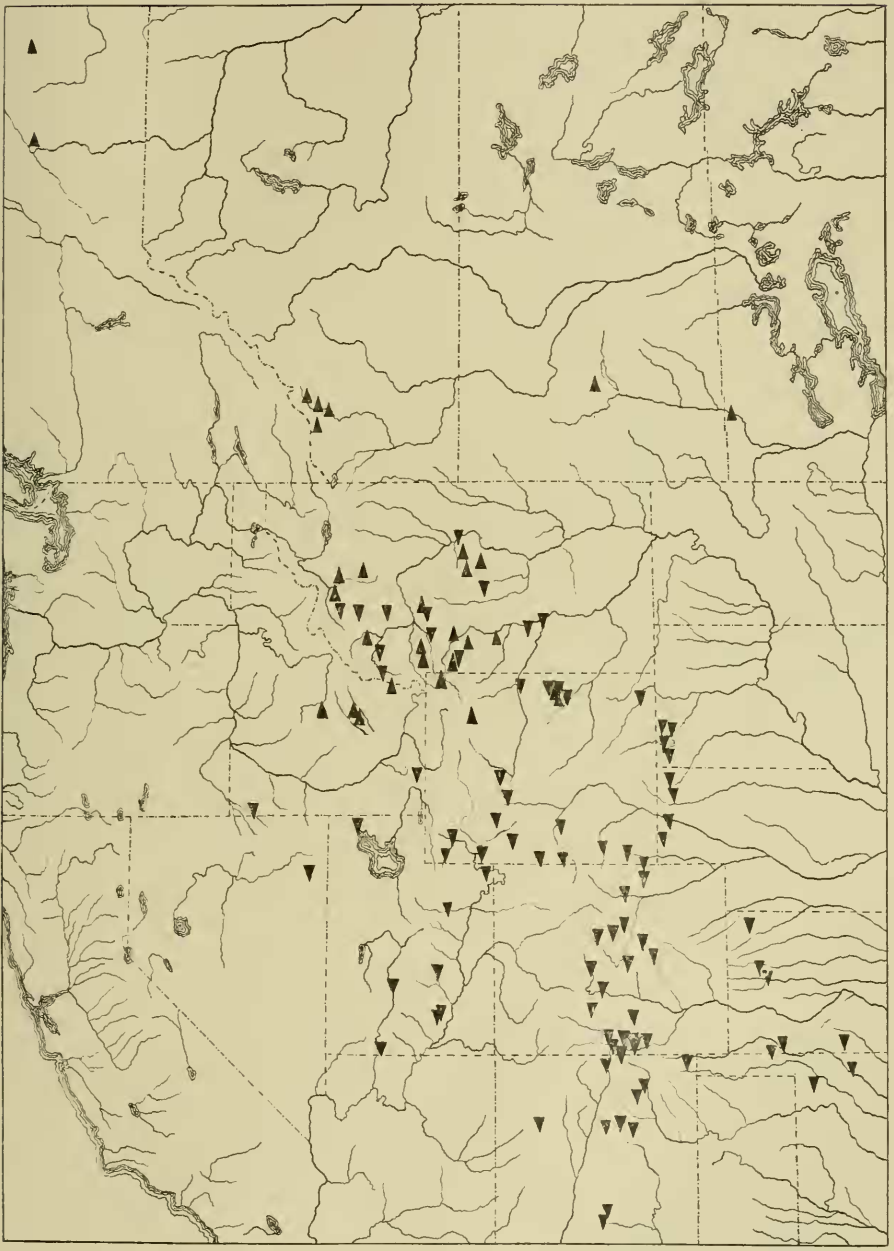
Aragallus aboriginum Greene, op. cit., 13. 1905.

Aragallus invenustus Greene, op. cit., 14. 1905.

As described for the species, but the corolla never pure yellow, commonly white or, if ochroleucous, the keel prominently maculate, rarely lilac or purple; plants tending to be robust, with open fruiting racemes; very variable, as discussed below. *Type* collected by Thomas Nuttall, in 1834, in the "Rocky Mountains"; Rocky Mts. towards the sources of the Oregon (doubtless southern Wyoming), *Nuttall* (NY)!

Distribution: Plains, prairies, and foothills of the Rocky Mountains, common from western Montana to the Black Hills of South Dakota, Oklahoma, central New Mexico, and occasional westward to northeastern Nevada, southern Utah, and southern Idaho, mostly between 3000 and 7000 ft. altitude, exceptionally reaching 11,000 ft. in the southern Rockies. Map 9.

Representative specimens: Idaho. Caribou Mts. s.-w. of Swan Valley, *J. & C. Christ* (RB). Montana. 20 mi. e. of Fort Benton, Chouteau County, *Wilcox 27* (NY). W. of Virginia City, Madison County, *C. L. Hitchcock 15820* (RB, WTC). South Dakota. Hot Springs, Fall River County, *Rydberg 637* (NY, US). Black Hills near Fort Meade, Meade County, *Forwood 96a, 96b* (US, cotypes of *Aragallus invenustus).* Wyoming. Pole Creek,



Map 9. Range of *Oxytropis sericea:* var. *sericea* ▼; var. *spicata* ▲.

Albany County, *A. Nelson 119* (NY, isotype of *Aragallus Lambertii ochroleucus).* Hulett, Crook County, *M. Ownbey 603* (GH, IDS, NY, WTC). W. of South Pass City, Fremont County, *C. L. Porter 4546* (RB, calyx villous, perhaps passage to *O. nana).* Bitter Creek, Sweetwater County, *A. Nelson 4773* (NY, US, isotypes of *Aragallus albiflorus condensatus).* N. of Lyman, Uinta County, *Rollins 2239* (GH, NY, WTC). NEBRASKA. Fort Robinson, Dawes County, Bates 1069 (NY, flowers purple). Scotts Bluff, Scotts Bluff County, *Rydberg 63b* (NY). NEVADA. East Humboldt Mts., Elko County, *M. E. Jones in 1900* (POM). UTAH. W. of Duchesne, Duchesne County, *Ripley & Barneby 4680* (CAS). Mt. Ellen, Henry Mts., Garfield County, *M. E. Jones 5674* (US, type of *Aragallus majusculus,* NY). Kanab, Kane County, *M. E. Jones in 1894* (POM, depauperate). COLORADO. Sangre de Cristo Range, alpine, *Brandegee 886* (NY, depauperate). Everett, Lake County, *Clokey 3537* (CAS, NY, POM, US, WTC). Divide, Teller County, *Clokey 3809* (CAS, flowers white or purple, NY, POM, WTC, flowers purple). KANSAS. Jennings, Decatur County, *Ripley & Barneby 8289* (WYO). Turkey Creek, e. of McAllester, *Rydberg & Imler 1144* (NY). NEW MEXICO. Llano Estacado, *Bigelow in 1853* (GH, US). Top of Las Vegas Range, *Cockerell 20* (NY, type of *Aragallus pinetorum veganus).* E. of Las Vegas, San Miguel County, *Ripley & Barneby 7525* (CAS, NY). S.-e. of Santa Fe, Santa Fe County, *A. & E. Heller 3751* (GH, ND, NY, OB, POM, US, WTC, isotypes of *Aragallus pinetorum).* OKLAHOMA. Cimarron Valley, Cherokee Outlet, *Carleton 217* and Indian Territory, *Carleton in 1891* (US, cotypes of *Aragallus aboriginum).* Cora, Woods County, *Stevens 218* (GH, NY, US).

Although one of the commonest and most characteristic plants of the easterly slope of the Rockies, and described as a species more than a century ago, *O. sericea* has had an oddly obscure and complicated taxonomic history. Nuttall's type is in advanced fruit, the color of the petals therefore unknown, and it has generally been interpreted as a silky phase of purple-flowered *O. Lambertii,* but the basifixed hairs and woody pod leave no doubt as to its identity. The species is abundant and not easily overlooked in the drainage of the North Platte, and it would be odd indeed if Nuttall, with his perspicacious eye, had failed to encounter it. Reports of early travellers (such as Geyer; cf. Hook., Jour. of Bot., 6:212, 1847, as *O. campestris β speciosa)* tell repeatedly of the white and purple locoweeds growing together, as they still do, on the prairies, where they were taken for color-forms of one species. This opinion was no doubt corroborated by the variation in color, from white to pale lilac and various tones of purple, found in some colonies of both *O. sericea* and *O. Lambertii.* These are believed to be the progeny of past hybrids and are often unusually robust and large-flowered. In any case Gray, having reduced *O. sericea* to *O. Lambertii* in his first revision (1864), revived it in the second (1884) as a variety, his concept at this time being of a large, copiously silky *(O. pinetorum)* phase, and he made no distinction as to color of the flowers. It so came about that with few exceptions *O. sericea* was thought to be no more than a strongly pubescent state of *O. Lambertii* and that *O. Lambertii* was as often as not white-flowered, an assumption which led Cockerell to distinguish as "*O. Lambertii* variety *lilacina*" the colored form of *O. sericea* which he knew in Custer County, Colorado. As *O. Lambertii* became better known, a distinction between more and less canescent states became untenable, and *O. sericea* was thus generally relegated to synonymy.

In his latest paper on the genus (1926) A. Nelson did take up *O. sericea* as a species, said to differ from *O. Lambertii* in the insubstantial character of "pink or pale purple" as opposed to "dark purple" flowers, but the material cited is a mixture of *O. Lambertii* var. *Bigelovii* and *O. Besseyi* var. *ventosa*. It has not been established exactly what Rydberg finally (Fl. Prair. & Pl., 484, 1932) had in mind as *O. sericea.*

The first recognition of a white-flowered species came in 1896, when Nelson, who knew it in the field, described his *O. Lambertii* var. *ochroleuca,* designating it "a good and constant variety, if not species." He soon raised this to specific rank as *Aragallus albiflorus,* for which he quickly substituted the epithet *saximontanus,* proposed in order to avoid competition with an earlier *Oxytropis albiflora,* though it was superfluous in *Aragallus.* When *Oxytropis* was placed on the list of *genera conservanda,* Nelson was able to make the further transfer to *O. saximontana.* However, in 1899 Heller had published on another type his *Aragallus pinetorum,* supposedly distinct from *A. albiflorus* (but here held synonymous), and this, although of later date than *A. albiflorus,* has a narrow priority over *A. saximontanus.* These three epithets, under various genera, have all found currency in the literature and especially in herbaria, and there has been widespread uncertainty as to the proper label for the white loco. But Nuttall's old and appropriate *O. sericea* antedates them all by many years.

The segregates here reduced to var. *sericea* are not all precisely similar, but seem to mark no more than random points on a scale of modification normal in the genus. The principal modes of variation can be described as follows:

Stature. Between the rather common "gigas" phase *(O. pinetorum, O. saximontana* and *A. majusculus),* with open raceme, tall scape, and ample foliage, and the relatively condensed, low, small-flowered desert extreme *(O. condensata)* every sort of intermediate is found and little significant geographic correlation. The large plant is perhaps more prevalent southward, but occurs sporadically north to central Montana, near the limit of the variety as a whole. It remains to be shown whether it is purely a response to favorable conditions or whether polyploidy is involved. The size of the leaflets (with extremes of 1 and 4 cm. in length) is not correlated with their number or with the plant's stature, with length of raceme or other characters.

Pubescence. In the type of *A. pinetorum* from Santa Fe County, New Mexico, the scapes are copiously ascending-hirsute; in that of *A. albiflorus* from Wyoming they are, like the whole plant, appressed-pilose. But in other material from near Santa Fe *(A. & R. Nelson 2201)* the loose hairs are few, while villous scapes occur here and there throughout the variety's range. In most collections from the southern prairies (Kansas, Oklahoma, New Mexico) the stipules are all permanently pilose dorsally, but even here, as commonly elsewhere, the blades may be glabrate. The vesture of the calyx in a collection from Wyoming *(A. Nelson 3146)* is instructive: in one plant white-pilose and lacking hirsute hairs, in another black and white-strigose, with prominently nigrescent teeth and some hirsute hairs on the tube. Transitional states in color, length and orientation of the calyx-hairs is everywhere apparent.

Corolla. The banner is normally about 2 cm. long and half or a little less as wide, but exceptionally ample or long petals are not infrequent *(A. Nelson 3146)*, and rarely the banner is as little as 16 mm. long *(Ripley & Barneby 8159)* and proportionately narrow. The degree to which the blades of the wing-petals are dilated upward is equally variable. No peculiarity of the flower has been found linked with another character of importance. Plants with many dark hairs in the inflorescence are more likely to bear ochroleucous flowers, those with a preponderance of pale hairs pure white flowers; but even here exceptions are numerous.

Pod. The pod is commonly about twice the length of the calyx and 5 mm. in diameter. In dry situations it may be much shorter, and occasionally (as in the type of *A. majusculus)* reaches a width of 7 mm. There exists a complete series between the extremes in otherwise like plants. In all fresh material examined the pod has been bilocular at and below the middle, but its valves are fleshy and as they dry out the walls shrink and a gap appears between the free edge of the false septum and the dorsal suture. The legume then appears imperfectly bilocular, and is perhaps truly so at times. The septum is about 2 mm. wide as a rule, but varies considerably in absolute width, this apparently correlated with the depth of the ventral sulcus and the degree of obcompression of the pod.

16b. **Oxytropis sericea** Nutt. var. **spicata** (Hook.) Barneby

Oxytropis sericea Nutt. var. *spicata* (Hook.) Barneby, Leafl. West. Bot., 5:111. 1951. *O. campestris δ spicata* Hook., Fl. Bor.-Amer., 1:147. 1834. *Aragallus spicatus* (Hook.) Rydb., Mem. N. Y. Bot. Gard., 1:251. 1900, pro parte, exclus. syn. *Oxytropis spicata* (Hook.) Pammell, Man. Pois. Pl., 2:569. 1911, nom. nud. *O. spicata* (Hook.) Standl., Cont. U. S. Nat. Herb., 22:373. 1921.

Oxytropis campestris γ sulphurea sensu Hook., Fl. Bor.-Amer., 1:147. 1834; non DC. *O. campestris β speciosa* T. & G., Fl. N. Amer., 1:341. 1838.

Aragallus Macounii Greene, Proc. Biol. Soc. Wash., 18:16. 1905, pro parte; Dayton, op. cit., 40:120. 1927, exclus. syn. ult. *Oxytropis Macounii* (Greene) Rydb., Fl. Pr. & Pl., 485. 1932.

Aragallus melanodontus Greene, Proc. Biol. Soc. Wash., 18:15. 1905.

Similar to var. *sericea*, commonly low, the scapes 7–15 (25) cm. long; stipules either permanently pilose dorsally or (at least those subtending the secondary leaves) glabrate, the free blades either strongly hispid-ciliate or bearing a few apical hairs; leaflets 11–15 (17), 7–22 (30) mm. long; calyx silky-pilose with mixed pale and dark hairs, the longer hairs sometimes lacking and then dark-strigose, the tube 6–8 mm., the nearly always nigrescent teeth (1.5) 2–3 mm. long; corolla pale yellow throughout, the banner 18.5–23 mm. long, 7–10.5 mm. wide; wings 14–19 mm. long, the blades strongly dilated upward and 5–7 mm. wide near apex; keel immaculate, (13) 14–16 mm. long; pod 16–25 mm. long, leathery, shortly pubescent with either mixed or wholly black hairs. *Type* collected by Drummond, between Carlton House on the Saskatchewan and the Rocky Mountains (probably Alberta); "*O. campestris δ spicata* ex herb. Hook." (GH, NY, presumed isotypes)!

Distribution: Prairies and gravelly hillsides, in dry or exposed places, often on talus in the mountains, western Manitoba to British Columbia (in the drainage of the Mackenzie River) south to central Idaho and northern Wyoming. Map 9.

Representative specimens: Without locality, "*O. campestris γ* ex herb. Hook" (NY, mounted with *δ spicata*, presumed type of var. *β speciosa* T. & G.). British Columbia. Mouth of Wicked River, lat. 58° 3′ N., *Raup & Abbe 3844* (GH, NY). Alberta. Elbow River, *Macoun 18513* (ND, type of *Aragallus melanodontus*). Calgary, *Macoun 18516* (ND, lectotype of *Aragallus Macounii*). Tunnel Mt. near Banff, *McCalla 2127* (NY, US, WTU). Saskatchewan. Old Wives Creek, *J. Macoun in 1895* (POM). Manitoba. Qu'Appelle River, *Macoun & Herriott 70799* (GH, NY, POM). Montana. N. of Philipsburg, Granite County, *Hitchcock & Muhlick 9141* (CAS, GH, WTC, WTU). Yogo Peak, Little Belt Mts., Judith Basin County, *Hitchcock & Muhlick 16159* (RB, WTC). Old Hollowtop near Pony, *Rydberg & Bessey 4505* (GH, NY). Idaho. Mahogany Creek, Lost River Mts., Custer County, *Hitchcock & Muhlick 11020* (GH, NY, WTC, WTU, keel purple-tipped). Ryan Peak, Custer County, *Hitchcock & Muhlick 10620* (CAS, GH, NY, WTC, WTU). Wyoming. The Thunderer, Yellowstone Park, *A. & E. Nelson 5813* (GH, NY, POM, US). Big Horn Mts. above Dayton, Sheridan County, *Ripley & Barneby 8028* (CAS).

In the foothills of the Canadian Rocky Mountains var. *spicata* is rather well marked by its medium-sized, yellowish corolla, predominantly dark-hairy calyx, and, as a rule, densely pilose primary stipules. The pod is a trifle thinner in texture than that of var. *sericea*, and its septum is often less pronounced, at times barely traversing half the width of the cavity, but sometimes complete. As the variety passes southward into Montana it intermingles and intergrades with var. *sericea* and the immaculate keel seems in some cases to be the only useful, though essentially superficial character. Among the extensive collections of forms collected by Hitchcock and Muhlick in the mountains of Idaho and Montana there are many that seem quite intermediate between var. *sericea* and var. *spicata* and these can only be arbitrarily assigned to one or the other. In the Big Snowy Mountains they found plants with flowers "pale yellow" *(No. 11912)* and "white and pink-lined to very pinkish in general aspect" *(No. 11919)* growing close at hand; whereas several collections from above timberline in Custer County, Idaho, combine the general stature and facies of var. *spicata* with pale yellow petals and maculate keel. Rydberg (Fl. Rocky Mts., 522, 1917) separated *Aragallus albiflorus* (var. *sericea)* from *A. spicatus* on the characters of the latter's yellow petals, narrow wings and nearly bilocular pod, as opposed to white or straw-colored petals, broad banner and wings ("fully 1 cm. wide"), and semi-bilocular pod of *A. albiflorus.* It is true that the petals are usually somewhat narrower in var. *spicata,* but we have examples of yellow flowers with banner over 1 cm. wide and of white flowers with banner not more than 7.5 mm. wide. The development of the septum is variable in both yellow and white-flowered (otherwise similar) plants, but it tends to be, if anything, narrower and less complete in var. *spicata.*

Considerable difficulty is met with in separating var. *spicata* from *O. campestris* sensu lato, especially when the pod is lacking. In fact no clean dividing line can then be drawn between the two. The commonest phase of *O. campestris* occurring in the range of var. *spicata* is *O. campestris* var. *gracilis,* as a rule distinguished by its numerous leaflets, much smaller corolla with narrower wing-petals, and by its more sparsely pilose and hence greener herbage. But occasional plants of undoubted var. *gracilis,* with the papery legume of the *O. campestris* alliance, may have relatively few (17) leaflets, banner up to 19 mm. long, wing-petals dilated and up to 5 mm. wide, or densely and permanently silky foliage and heavily pilose stipules. The *"cervinus"* state of var. *gracilis* (more fully discussed under that heading) bears a corolla quite as ample as average var. *spicata,* and leaflets as few as 13 to the leaf. A few dwarf flowering specimens from subalpine habitats in Montana (cf. Tobacco Root Mts., *C. L. Hitchcock 16962)* seem to be depauperate var. *spicata,* but closely resemble *O. campestris* var. *Cusickii* in habit and reduced raceme, and it is difficult to be sure of their proper place in absence of the legume. It will be seen, in any case, that var. *spicata* occupies a critical position between the predominantly southern and lowland *O. sericea* and the mostly northern and montane *O. campestris,* and forms a link between the latter widely dispersed and complex circumboreal species and the presumably derived, purely North American *O. sericea.*

In the circumstances it is hardly surprising that var. *spicata* was at first subordinated by Hooker to a widely inclusive *O. campestris,* from which it was said to differ only in the loosely flowered and elongate spike. Specimens of an *Oxytropis* with open raceme, communicated by Hooker, are preserved in the herbaria of Gray and Torrey under the label "*O. campestris* δ Hook.," and have been taken as authentic for the var. *spicata* of Flora Boreali-Americana, presumably collected by Drummond in Canada. Mounted with this in the Torrey Herbarium is a smaller plant with condensed raceme and somewhat shorter leaves (but otherwise similar), no doubt the *O. campestris* γ *sulphurea* of Hooker. Since the length of the raceme and leaves prove to be inconsiderable differences, and the plants are alike in details of corolla, stipule, and vesture, Hooker's two varieties are believed to be synonymous. Both types are matched by modern Canadian material with leathery legume and doubtless belong to the taxon under discussion.

Except for their appearance in a few early lists and in Torrey and Gray's *Flora* (where var. *sulphurea,* rightly considered different from the original var. *sulphurea* Fisch. ex DC.[14], was renamed var. *speciosa),* the idea of Hooker's varieties suffered a long eclipse. Neither is mentioned in Gray's first revision (1864), but it is stated in the second (1884) that var. *spicata* "seemed . . . to belong to *O. Lambertii,*" and from annotations it is clear that Gray was treating both as part of his much too inclusive *O. Lambertii.* Rydberg revived var. *spicata* (as *Aragallus)* in 1900, and reduced to it the earlier *A. albiflorus,* a procedure justified by the nomenclatural code then in fashion. Subsequently the specific epithet was twice used in *Oxytropis,* by Pammel (1911) and by Standley (1921). The first was a *nomen nudum,* and the second, owing to lack of citation of the basonyn (there was a reference only to "*Aragallus spicatus* Rydb.") was so considered by Dayton, who took up for the same *Aragallus Macounii* Greene. This species was based on two collections from near Calgary, Alberta, *Macoun 18516* and *18517.* The first, which is undoubtedly var. *spicata,* is here taken as lectotype; the other belongs to *O. campestris* var. *gracilis. Aragallus melanodontus* Greene is merely the common dark-hairy state of var. *spicata.*

17. **Oxytropis nana** Nutt.

Oxytropis nana Nutt. ex T. & G., Fl. N. Amer., 1:340. 1838. *Spiesia nana* (Nutt.) O. Kze., Rev. Gen., 206. 1891. *Aragallus nanus* (Nutt.) Greene, Pittonia, 3:212. 1897. *Astragalus Tomae* Tidestr., Proc. Biol. Soc. Wash., 50:18. 1937 (non *A. nanus* DC.).

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[14] *Oxytropis campestris* var. *sulphurea* Fisch. ex DC., Prod.., 2:278. 1825, based on a plant of Altai, was described as very close to European *O. campestris,* but as having larger flowers. It was accepted as a species by Ledebour, and it is beautifully figured in Ic. Fl. Ross. Pl. 55. 1829. A specimen from Fischer in the Torrey Herbarium is a good match for the plate and is probably authentic var. *sulphurea.* It does not closely resemble any native American species.

Aragallus collinus A. Nels., Erythea, 7:57. 1899, pro parte, exclus. char. fruct. *Oxytropis collina* (A. Nels.) K. Schum., Just's Jahresb., 27^1:496. 1901. *O. Lunelliana* A. Nels., Univ. Wyo. Pub. Bot., 1:117. 1926[15].

Densely cespitose, silky-pilose throughout, silvery or sometimes greenish; stipules membranous and connate opposite the petiole but early ruptured, 8–15 mm. long, the deltoid to deltoid-lanceolate free blades 3–6 mm. long, the whole densely and permanently silky-pilose dorsally, rarely glabrate distally, at length becoming chartaceous and persistent; leaves somewhat dimorphic, 2–9 (11) cm. long, the petioles 1–4 (5) cm. long, pilose with subappressed and loosely ascending hairs; leaflets 7–11 (13), narrowly to broadly lance-oblong, lanceolate or elliptic, 5–30 mm. long, acute or on the primary leaves sometimes obtuse; scapes erect or arcuate-ascending, 3–10 (15) cm. long, ascending-pilose; racemes 5–19-flowered, dense at first, at full anthesis oblong to subcapitate, the axis becoming looser and 1.5–5 (7) cm. long in fruit; bracts narrowly ovate to lanceolate, 4–10 (15) mm. long, herbaceous, densely pilose dorsally; calyx so densely shaggy-hirsute and subtomentose with white hairs as completely to conceal the surface, cylindro-campanulate in early anthesis, soon becoming inflated and urceolate, 9–11 mm. long, the teeth subulate-deltoid, pubescent within, 1.5–2.5 (3) mm. long, the whole in fruit 11–16 mm. long, constricted at the mouth, the teeth then erect or connivent; pedicels 1 mm. long or less, not jointed to the axis; petals purple, or white with a purple-spotted keel; banner 18–22.5 mm. long, the oblong-obovate blade (6) 8–15 mm. wide; wings nearly as long, the blades obliquely dilated upward, 12–14 mm. long, (4.5) 6–9 mm. wide near the truncate-emarginate apex; keel 15–17 mm. long, the blades 9.5–10 mm. long, including the straight or slightly declined appendage; pod subsessile, included in the calyx and tardily deciduous with it, the ovoid, obcompressed body 7–10 mm. long, 4–5 mm. in diameter, passing into an acuminate beak about 5 mm. long, somewhat sulcate ventrally, the valves coriaceous, rigid, strigose-canescent, the seminiferous suture produced as a false septum 0.3–1.5 mm. wide; seeds olive-brown, 1.8–2 mm. in diameter. *Type* collected by Thomas Nuttall, in 1834, on the "Plains of the Platte in the Rocky Mountain Range" (i. e. Wyoming); "R[ocky] Mts.," *Nuttall* (PH, NY)!

Distribution: Open limestone, shale or cobblestone bluffs and hilltops, between 6600 and 10,000 ft. altitude in the drainage of the North Platte and Cheyenne rivers, westward to the Wind River Range, Wyoming. Map 6.

Representative specimens: WYOMING. Seminoe Mts., Carbon County, *E. Nelson 4925* (GH, NY, US, isotypes of *Aragallus collinus*). 14 mi. n. of Rawlins, Carbon County, *Ripley & Barneby 7745* (CAS, NY). N.-w. of

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[15] A substitute for *O. collina* K. Schum.; but the supposed obstacle, *O. collina* Turcz., Bull. Soc. Nat. Mosc., 25:741, 1842, was merely listed by Turczaninow as a synonym, and no evidence of subsequent validation has been traced.

Orin, Converse County, *Ripley & Barneby 8958* (CAS). Alcova, Natrona County, *Goodding 147* (NY, POM). Platte River Canyon above Goose Egg, *Ripley & Barneby 8938* (CAS, NY, WYO). N.-e. of Rochelle, Weston County, *C. L. Turner 91* (RB).

Oxytropis nana is a species of restricted range which has been consistently misinterpreted and virtually lost sight of since Nuttall's day. The most perfect example of the type-collection which has been studied is that in the Torrey Herbarium, and consists of a dwarf plant with two capitate racemes of young, relatively large purple flowers (the wings and banner 18 mm. long), short leaves with seven leaflets, and broadly cylindro-campanulate, silky-pilose calyx with tube 7 mm. and teeth 2 mm. long. It is matched at all points by the smallest flowering individuals in a collection *(Ripley & Barneby 8952,* CAS, NY, WYO) from chalky shale ridges on the Platte above Alcova, and since this station is quite near Nuttall's route through Wyoming, the identity of his original gathering seems well established. This being so, the epithet *nana* becomes something of a misnomer, for the depauperate type gives no indication of the luxuriance and size of well nourished plants. Recent collections from the North Platte valley in Natrona and Converse counties exhibit a complete sequence ranging from the diminutive equivalent of the type into a relatively giant thing with oblong inflorescence held on stout peduncles up to 15 cm. tall. There seems no essential difference between the large extreme of *O. nana* and the type of *A. collinus,* except for the latter's white corolla. The type of *A. collinus,* from about 10,000 feet in the Seminoe Range, not more than twenty miles south of Alcova, is more ample in the leaf than most of purple-flowered *O. nana.* Only one collection (10–15 mi. s. of Lander, Fremont County, *T. & F. Craig 3552,* POM) has been seen which exactly duplicates *A. collinus;* but the ventricose-inflated calyx, dimensions of the petals and forming legume are in no way different from those of *O. nana.* Moreover, we have white-flowered material from the southern foothills of the Seminoe Range (Rawlins, Parco) which, while maintaining the coloring of *A. collinus,* varies in stature and amplitude of leaf down to a depauperate extreme otherwise inseparable from the original *O. nana* of Nuttall. And in plants from Muddy Gap on a spur of the Ferris Mountains, a western prolongation of the Seminoe Range *(Ripley & Barneby 9134,* CAS, WYO) the fresh flowers were white flushed with pink at the base of the banner and wings. So far we have no evidence that purple and white flowers occur in the same population, as happens in the polychrome races of *O. sericea* and *O. Lambertii.* The question arises, nevertheless, as to whether *O. nana* was not originally of hybrid origin, and it does seem possible that a cross between *O. sericea* and *O. multiceps* might inherit the necessary characters, from the first the white corolla and coriaceous pod, from the second the purple corolla and inflated calyx. An attempt should be made to obtain an example of *O. nana* experimentally by controlled hybridization. In any case *O. nana* is certainly established as a self-perpetuating species at the present time.

The name *O. nana* has been applied to diverse species and, by accretion of extraneous elements, has become altogether vague and ambiguous. In his first revision (1864) Gray referred to it Cooper's plant from Montana which much later became the type of *O. Besseyi* var. *argophylla;* in his second (1884) he added more of the same *(Watson 94,* GH), and described the fruit from *Parry 91,* a specimen of *O. Lagopus.* By coincidence this happens to have a small pod enclosed in the inflated calyx similar to that of true *O. nana* (of which fruit was at the time unknown), but the pod is of thinner texture, villous, and the flower is smaller. These errors have persisted, and current descriptions of *O. nana,* derived at least in part from Gray's mixed concept, portray a chimerical mixture of *O. Besseyi* and *O. Lagopus.*

18. **Oxytropis Lambertii** Pursh

Cespitose, the few to many crowns sessile on the summit of a stout taproot or on the short clustered divisions of the caudex; pubescence dolabriform, usually subappressed-pilose, sometimes looser and hirsute or villous, sparse to very copious, the herbage thus silky-canescent or greenish; stipules pale, at first membranous and connate opposite the petiole, early ruptured and at length becoming chartaceous and persistent, 7–24 mm. long, pilose or even sericeous dorsally, or those of the secondary leaves commonly glabrate, the deltoid to deltoid-acuminate, sometimes subherbaceous free blades 2–9 mm. long; leaves strongly dimorphic or subhomomorphic, but the primary nearly always shorter, (2.5) 5–21 cm. long, erect or spreading, the petioles and rachis appressed-pilose, glabrate, or bearing some loosely ascending hairs; leaflets (3) 7–15 (19), linear, lance-linear, elliptic or ovate, acute or acutish, when narrow usually falcate, membranous or thick and rigid, the margins variously elevated or involute; scapes erect or ascending, 5–25 cm. long, commonly surpassing the leaves; racemes (6) 10–25-flowered, either dense or lax, (2) 2.5–3.5 (4) cm. wide at full anthesis, the flowers subhorizontal to nearly erect, the axis elongating and becoming (2) 4–17 cm. long in fruit; bracts herbaceous, lanceolate to ovate-acuminate, 2–10 mm. long, more or less pilose dorsally; pedicels very short; petals pink-purple, rarely white, or of many intermediate shades of rose, lavender, and purple; calyx cylindric, (6.5) 7–11 mm. long, the purplish tube silky-strigose or -pilose, rarely with some dark or some loose hairs, the subulate to triangular-subulate teeth 1.2–4 mm. long; banner (13) 15–25 mm. long, the emarginate, somewhat fiddle-shaped blade 8–12 mm. wide; wings 13.5–20 mm. long, the oblique blades variably dilated upward, 5.5–8 mm. wide near the truncate or emarginate apex; keel (12) 13–19 mm. long, the straight or slightly arched appendage 1–2 mm. long; pod sessile or shortly stipitate, long persistent and dehiscent on the raceme, ovoid to lance-acuminate in outline and passing upward into an erect or abruptly divaricate, conic or acuminate beak, more or less obcompressed and strongly sulcate ventrally, the valves coriaceous to woody, strigose-silky or merely strigulose, the seminiferous suture produced across the cavity as a complete or nearly complete partition; seeds dull brown, 1.9–2.1 mm. in diameter.

The purple loco, in the large sense, is distinguished from all American (and perhaps Old World) species of its genus by the dolabriform attachment of the pubescence. In its most pubescent phase it resembles the usually white or pale yellow-flowered *O. sericea,* like it in the leathery texture of the pod. On the eastern slope of the Rockies, and occasionally westward, the two species grow together, and can be separated with certainty, after the flowers are past, only by the form of the vesture. But as a rule, and disregarding the polychrome hybrids more fully discussed below, *O. Lambertii* is distinguished by its purple corolla. The species presents many problems.

In their *Illustrated Flora,* Britton and Brown were able to accept from their area only a single species in the *O. Lambertii* complex, though they remarked that this consisted ''of several races, differing in amount of pubescence, shape and size of leaflets, color of flowers, and shape of pods.'' Several attempts have been made to define these races. For example, Rydberg recognized five species as occurring in the Rocky Mountains and adjacent plains, and Nelson six from the prairies alone, with two more from the mountains to the west. The criteria stressed by these authorities cannot be applied to any representative suite of specimens, as one or two examples of the many that spring to mind will help to show. Rydberg separated *Aragallus Lambertii* from *A. angustatus* on the basis of its erect, not spreading leaves; its slightly longer, straight legume; and its longer corolla, with banner 18–20 (as opposed to 15) mm. long. Unfortunately in part of the type of *A. angustatus* the foliage is erect; short, straight pods and longer pods with divaricate beak are found in otherwise similar plants; while the banner of Pursh's original *O. Lambertii* is only 15–17 mm. long. In Nelson's key we find the ''Blue Loco,'' *O. patens,* placed in a group characterized by ''pod suberect, with spreading beak''; but in the type of this species, part of which was cited by Nelson, the legumes spread from the axis of the raceme at a wide angle (whence the epithet *patens),* and are nearly straight, as indeed Rydberg originally described them. It was found possible to identify from Nelson's and Rydberg's keys less than half of the hundred-odd collections of *O. Lambertii* in the New York Botanical Garden, and even then the determinations were seldom in agreement. The criteria adduced by these authors in support of their segregate species are evidently of a trivial nature. In *O. Lambertii* the length of the scape and of the raceme, the orientation of the leaves and pods, the absolute size and width of the petals and their length relative to the calyx, the length of the pod and the curvature of its beak are all variable within a single and presumably monophyletic population. When several characters diverge together from the normal or average state, the result is striking; but since the observed differences occur in every sort of combination, a segregate based on any one or two of them has no solid basis as species.

While no more than a single species can be made out in the multitudinous races and aspects of *O. Lambertii,* definite geographical trends exist. Thus plants from the prairies, from Manitoba to Texas, are almost invariably characterized by long and narrow leaflets and a toughly coriaceous or woody pod. To the north the prevailing phase has rather thin and flaccid stems and herbage, and the pod is commonly well exserted from the calyx at maturity, whereas to the south this passes into populations with thick and rigid leaflets, and shorter, scarcely exserted pod. Exceptions to this general rule are noted under the appropriate heading below. In cordilleran *O. Lambertii* the leaflets are nearly always of a broader type and the pod is less firm in texture and often stipitate. The intergradation between the prairie and montane types is complete where the plains climb westward into the foothills of the Rockies, and occasional individuals from well within the territory of each exhibit the leaflet outline prevalent in that of the other. Nonetheless the quantity of material which falls into either category is impressive, and even though it is not possible to define them in exact terms, they may conveniently be accepted as geographic varieties. It should be emphasized that the ensuing key does not cover every individual to be met with in nature, but it can be usefully applied to a large proportion of the material examined.

KEY TO THE VARIETIES OF O. LAMBERTII

1. Pod strictly sessile.......... 2

— Pod stipitate..........18c. var. *Bigelovii*

2. Leaflets of the developed secondary leaves narrowly linear-lanceolate or linear, commonly elongate, 5–10 times as long as their greatest width; pod toughly leathery or woody; plants of the prairie states, Manitoba to Texas.......... 3

— Leaflets of the developed secondary leaves of a broader type, elliptic or ovate, about 3–5 times as long as their greatest width; pod of thinner texture; plants of the Rocky Mountain states, Wyoming to New Mexico and s. Arizona..........18c. var. *Bigelovii*

3. Calyx-tube about 3 times longer than the teeth; corolla relatively small, the banner 18 mm. long or less; body of the pod about twice as long as the calyx; herbage and scapes commonly thin and flaccid; Kansas northward..........18a. var. *Lambertii*

— Calyx-tube 4–5 times longer than the teeth; corolla large, the banner 18–25 mm. long; body of the pod about equalling the calyx or, if exserted, the calyx-teeth very short; scapes and leaflets usually thick and rigid; Oklahoma and Texas..........18b. var. *articulata*

18a. **Oxytropis Lambertii** Pursh var. **Lambertii**

Oxytropis Lambertii Pursh, Fl. Amer. Sept., 740. 1814. *Astragalus Lambertii* (Pursh) Spreng., Syst., 3:308. 1826. *Spiesia Lambertii* (Pursh) O. Kze., Rev. Gen., 206. 1891. *Aragallus Lambertii* (Pursh) Greene, Pittonia, 3:212. 1897.

Oxytropis Lambertii γ T. & G., Fl. N. Amer., 1:339. 1838.

Oxytropis Hookeriana Nutt. ex T. & G., op. cit., 340. 1838.

Oxytropis plattensis Nutt. ex T. & G., loc. cit., 1838.

Aragallus involutus A. Nels., Erythea, 7:64. 1899. *Oxytropis involuta* (A. Nels.) K. Schum., Just's Jahresb., 27^1:496. 1901.

Oxytropis Bushii Gand., Bull. Soc. Bot. France, 48:xvii. 1901.

Aragallus falcatus Greene, Proc. Biol. Soc. Wash., 18:13. 1905. *Oxytropis falcata* (Greene) A. Nels., Univ. Wyo. Pub. Bot., 1:118. 1926.

Aragallus formosus Greene, Proc. Biol. Soc. Wash., 18:13. 1905.

Aragallus rigens Greene, op. cit., 14. 1905.

Aragallus angustatus Rydb., Bull. Torr. Club, 34:422. 1907. *Oxytropis angustata* (Rydb.) A. Nels., Univ. Wyo. Pub. Bot., 1:116. 1926.

Aragallus Aven-Nelsonii Lunell, "Bull. Leeds Herb., 2:6. 1908," reprinted in Fedde, Repert. Sp. Nov., 8:245. 1910. *Oxytropis Aven-Nelsonii* (Lunell) A. Nels., Univ. Wyo. Pub. Bot., 1:116. 1926.

Oxytropis Lambertii fma. *mixta* Gand., Bull. Soc. Bot. France, 48:xvii. 1901, pro parte.

Commonly thinly pilose and greenish, sometimes silky-canescent throughout, the hairs appressed, or the scapes and petioles often ascending-hirsute, the vesture becoming tawny when dry; stipules thinly to densely pilose dorsally, the free blades commonly glabrate; leaves more or less dimorphic, (2) 5–17 (23) cm. long, with (5) 9–19 linear, linear-lanceolate or narrowly oblong, often falcate, flaccid or rigid leaflets (3) 5–40 mm. long, 1–4 (6) mm. wide; scapes erect or rarely ascending, 4.5–25 cm. long; racemes 6–18-flowered, usually narrow and becoming lax at full anthesis, 3–15 cm. long in fruit; calyx pilose, rarely with some dark hairs, 7–10 mm. long, the tube 5.5–8 mm., the teeth (1.5) 2–4 mm. long; corolla pink-purple, exceptionally white, the banner (13.5) 15–20 mm. long, 7–10 mm. wide; wings (12) 14–18.5 mm. long, the blades slightly dilated upward, 4–5.5 (6) mm. wide near apex; keel 12–16.5 mm. long; pod sessile, the erect body 8–15 mm. long, equalling or twice as long as the calyx, 3.5–5 mm. in diameter, passing into the nearly straight to strongly divaricate beak 3–7 mm. long, the valves stiffly coriaceous or woody, castaneous and at length blackening after dehiscence, thinly to densely strigose-pilose. *Type* collected by Bradbury, in 1811, "on the Missouri," more precisely[16] "on the bluffs from the Maha village to the Poncars"; "Louisiana," *Bradbury in 1811* (PH)!

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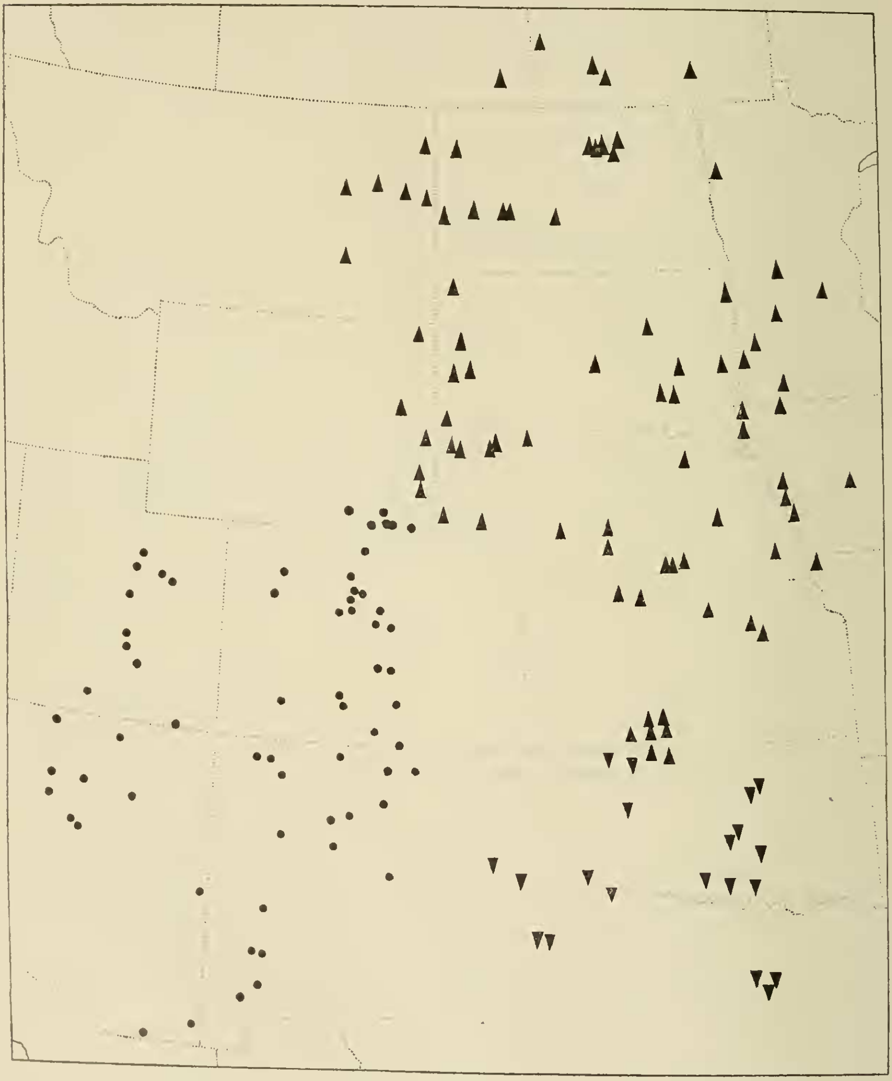
[16] Bradbury, Trav. Inter. N. Amer., Ed. 2, 346. 1819. As shown by Nelson (Univ. Wyo. Pub. Bot., 1:111), this locality is on the stretch of the Missouri River which now serves as boundary between Nebraska and South Dakota. Bradbury's map places the Maha or Mahar village about at the present Sioux City, and his Journal describes the encounter with the Poncars near the mouth of L'Eau qui Court River.

Distribution: Prairies, river-bluffs, and badlands, on clay, limestone, or loess, Manitoba and eastern Montana to western Missouri and Kansas, where it passes into var. *articulata.* Map 10.

Representative specimens: SASKATCHEWAN. Souris Plains, *Macoun 453* (US). MANITOBA. N. of Carberry, *Macoun & Heriott 70797* (CAS, GH, NY,



Map 10. Range of *Oxytropis Lambertii:* var. *Lambertii* ▲; var. *articulata* ▼; var. *Bigelovii* ●.

POM). MONTANA. Cedar Creek, 12 mi. above Glendive, Dawson County, *Ward in 1884* (US, type of *Aragallus rigens).* NORTH DAKOTA. Butte, Benson County, *Lunell, June 14, June 21 and July 2, 1908* (NY, US, WTC, isotypes of *Aragallus Aven-Nelsonii).* Leeds, Benson County, *Lunell in 1906* (NY, US). SOUTH DAKOTA. Hot Springs, Fall River County, *Rydberg 638* (NY). Fort Meade, Meade County, *Forwood 95* (US, type of *Aragallus formosus).* MINNESOTA. Acton, Meeker County, *W. D. Frost in 1892* (MINN, US, isotypes of *Aragallus involutus).* WYOMING. Hulett, Crook County, *M. Ownbey 664* (NY, WTC). NEBRASKA. Minden, Kearney County, *Hapeman in 1928* (NY, POM). Rush Creek, Sheridan County, *Rydberg 82c* (NY, type of *Aragallus angustatus).* IOWA. Bluffs at Missouri Valley, Harrison County, *Eggleston 15163* (GH, NY, US). KANSAS. Coldwater, Comanche County, *Rydberg & Imler 709* (NY). MISSOURI. Watson, Atchison County, *Bush 204* (GH, ND, NY, US, isotypes of *Aragallus falcatus* and of *O. Bushii).* OKLAHOMA. Alinc, Alfalfa County, *Mark White in 1899* (NY).

Variation in var. *Lambertii* is especially marked in four directions: stature, density of vesture, texture and outline of the leaflets, and length of pod. The precisely typical form is of medium stature, silky-pilose with appressed hairs, and has submembranous leaflets with inconspicuously elevated margins. In similar modern collections the pod is commonly twice the length of the calyx, rarely shorter and with the beak only exserted. This is the form characteristic of virgin prairie, associated with grassland and rich soil. A common xerophytic modification, occurring on dunes, eroded clay bluffs or loess mounds here and there in the variety's range, has narrower, involute and sparingly pilose leaflets of thicker texture, stiffer scapes, and nearly always short pod. When tall, with open racemes, this corresponds with *Aragallus rigens;* when low and with short racemes, with *A. angustatus* and *A. Aven-Nelsonii.* In *O. Bushii* (or *A. falcatus,* based on part of the same collection) the foliage is of the xerophytic type but the pod is exserted. A phase common about the Black Hills and occasional elsewhere is densely and on occasion loosely pilose throughout, with thin and sometimes broader leaflets. A robust example of this state furnished the type of *Aragallus formosus,* a depauperate one that of *O. plattensis.* Greene described the flower of *A. formosus* as "cardinal red," but Forwood's field-label, preserved on the type-sheet, reads: "common on the plains, bright red, showy," and there is no reason to believe that the petals were anything more than the brilliant pink-purple common in the species. The type of *O. plattensis* is remarkable for its small corolla and densely villous stipules, and is perhaps the most isolated extreme yet known. However we have from the Badlands of North Dakota a plant *(Ripley & Barneby 8247,* CAS) nearly as villous, but with taller stems and larger flowers. This occurred in the field under two forms, one densely canescent and with short pod growing on bare clay ridges, the other greener and with longer pod found in the intervening gulches. No adequate criteria have been found by which these diverse aspects can be maintained above the rank of forma.

The segregates discussed so far have for the most part been ignored or reduced, or if listed they have been neither defined nor described. However the name "*O. dispar*" has gained a foothold in the literature of the plains states, and deserves fuller notice. The actual type of *Aragallus dispar,* and hence the name, does not belong to the *O. Lambertii* complex; it has basifixed pubescence and represents a race of *O. campestris,* treated above as var. *dispar.* Rydberg however, applied the name (Fl. Rocky Mts., 571) to a race of *O. Lambertii,* citing his own *Aragallus patens,* a true *Lambertii* segregate, as synonymous; and practically all Nelson's *O. dispar* of his 1926 paper (Univ. Wyo. Pub. Bot., 1: 114) belongs to *O. Lambertii* also. Thus "*O. dispar*" has come to stand for a species related to *O. Lambertii* but distinguished by strongly dimorphic leaves and short calyx-teeth. Unfortunately leaf-dimorphism is more nearly a character of the genus than of any species in it, and is almost universal in *O. Lambertii.* Even in the type of *O. Lambertii* the primary leaves are short (as little as 5 cm. long), with leaflets 4 mm. long and 1.5 mm. wide, while the secondary leaves reach a length of 13 cm., with leaflets up to 18 mm. long and 2.5 mm. in width. This is a normal or average state of dimorphism for the species, but in some phases the difference in shape and size of leaflets is accentuated. In this respect, much depends on the immediate environment of the individual plant. The primary leaves, formed in autumn and persisting over winter in the form of a terminal bud, expand in the cool temperatures of early spring, and tend to be short and pressed to the ground. Where a plant has seeded into dry or barren ground, the secondary leaves which accompany the scapes may be quite similar, though always longer. By contrast in a plant surrounded by rapidly developing vegetation, as is the case under prairie-conditions, the secondary foliage is more lush and drawn out, and the leaflets are longer. Short calyx-teeth, supposedly characteristic of "*O. dispar,*" are rather uncommon in var. *Lambertii,* but do occur occasionally far to the north of the range of var. *articulata,* of which they are nearly characteristic. But they are in no way correlated with strongly dimorphic leaves.

The early treatments of *O. Lambertii* call for some comment. In *Flora Boreali-Americana,* Hooker divided the species into vars. α and β, neither of which corresponds altogether with the modern concept. The var. β was based on collections obtained by Douglas and Drummond in Canada which represent a form intermediate between *O. viscida* and *O. campestris* var. *gracilis,* further discussed under the heading of *O. viscida.* To var. α Hooker referred several collections of *O. campestris* var. *johannensis,* and a figure, Botanical Magazine No. 2147. Torrey and Gray (Fl. N. Amer., 1: 339) did something to correct this treatment, excluding from their typical (var. α) *O. Lambertii* all of Hooker's which was then divided between a dubious var. δ for the Quebec plants and a new var. γ based on the Sims plate. This last depicts a somewhat large-flowered form of *O. Lambertii* and was modelled on a plant grown in Lambert's garden from seed collected by Nuttall on "woodless hills of the Missouri." Since we have not only specimens collected by Nuttall ("Louisiana," *Nuttall*, PH ex herb. Lambert.) but, more importantly, Pursh's testimony that he had seen *O. Lambertii* growing in England ("v. v. in hort. Lambert" ex char.), it can scarcely be doubted that the plate and therefore Torrey and Gray's var. γ are essentially typical. A further variety, *O. Lambertii* ϵ T. & G. has remained unidentified; cf. excluded species, inf.

Authentic material of *O. Hookeriana* Nutt. ex T. & G. is apparently lacking in American herbaria. At the writer's request Mr. N. Y. Sandwith obligingly sought out the type-specimen in the British Museum, and reported that he found a sheet bearing the characteristic star and legend in Nuttall's hand: "*O. Hookeri. O. Lambertii β* Hook. Platte Plains." The presence of dolabriform hairs, as found by Sandwith, definitely places *O. Hookeriana* as a form of *O. Lambertii.* The calyx-teeth are "3–4 mm." long, the extreme length attained in var. *Lambertii* but not unusual. The epithet *Hookeriana* is explained by Nuttall's apparent intention of renaming Hooker's *O. Lambertii β*. But this, as we have seen, is not related to *O. Lambertii* and is certainly not conspecific with Nuttall's plant.

The aptly named *O. Lambertii* var. *mixta* was described from a plant collected by Lycurgus Moyer at Montevideo, Minnesota, and on part of *A. Nelson 1320* from Wyoming. Topotypes collected at Montevideo *(Moyer in 1909,* NY) are var. *Lambertii,* and the actual type can scarcely belong elsewhere. The Wyoming plant represents var. *Bigelovii.*

18b. **Oxytropis Lambertii** Pursh var. **articulata** (Greene) Barneby

Oxytropis Lambertii Pursh var. *articulata* (Greene) Barneby, Leafl. West. Bot., 5:111. 1951. *Aragallus articulatus* Greene, Proc. Biol. Soc. Wash., 18:13. 1905.
Aragallus abbreviatus Greene, op. cit., 12. 1905.

Green but finely pilose throughout; leaflets (7) 9–19, narrowly linear to linear-oblong, 10–35 mm. long, 1–3.5 (5.5) mm. wide, commonly thick and rigid, rarely thinner and flaccid; calyx silky-pilose, the tube 6–8 mm., the triangular-subulate teeth 1.2–3 (very rarely 4) mm. long; corolla relatively large, the banner 18–25 mm. long; wings 15–25.5 mm. long, commonly much dilated upward; keel 14–19 mm. long; pod stiffly woody, the body ovoid to oblong-ovoid, commonly 7–10 mm. long and scarcely exserted, but sometimes up to 17 mm. long and nearly twice as long as the calyx, the stout beak commonly divergent and 3–5 mm. long, the valves densely silky-strigose, the partition as a rule not quite complete. *Type* collected by J. M. Bigelow, in 1853, ''on the Canadian River, perhaps within the limits of Colorado,'' but according to the label, between Fort Smith and the Rio Grande, hence either Oklahoma or western Texas; *Bigelow in 1853* (US)!

Distribution: Prairies and bluffs, often on gypseous or calcareous soils, Oklahoma and western Texas. Map 10.

Representative specimens: OKLAHOMA. Fort Sill, Comanche County, *Mrs. Clemens 11683* (CAS, GH). Hennepin, Murray County, *Ripley & Barneby 7463* (CAS). TEXAS. Near Dallas, Dallas County, *J. Reverchon 603* (ND, type of *Aragallus abbreviatus), distrib. Curtis No. 603* (NY, isotype), *No. 4329a* (NY). Tarrant County, *Ruth 25* (GH, NY). Giles, Donley County, *Ripley & Barneby 7502* (CAS).

As here circumscribed, var. *articulata* is nearly as polymorphic as var. *Lambertii*, and the diverse materials referred to it are not distinguished by any single infallible character. Nearly all the plants seen from south of the Oklahoma state line are alike in their relatively large flowers and in the proportion of calyx-tube to teeth, the latter being for the most part absolutely, and with rare exceptions relatively much shorter than in var. *Lambertii.* The phase to which the type belongs is the extreme xerophyte, with narrow, rigid leaflets and shortly ovoid, scarcely exserted pod; and this is the common form throughout the range of the variety. Plants similar in aspect occur here and there northward to Montana, but these have the short calyx-tube and long teeth of var. *Lambertii,* and are interpreted as more trivial modifications due to arid habitat. Just as the latter simulate var. *articulata,* so we find plants from central Texas with exserted pod and more ample herbage which ape var. *Lambertii* in appearance, but are distinguished by their short calyx-teeth and extremely large petals. To this form, which is included in var. *articulata* as a minor variant, belongs the type of *Aragallus abbreviatus.*

The variety is a weak one, particularly since so many combinations of characters are found within it, and some specimens suggest direct intergradation with var. *Lambertii* or, in somewhat broad leaflets, with var. *Bigelovii.* The following average measurements of calyx and banner taken from twenty representative collections of var. *articulata* and as many of var. *Lambertii* disclose real differences which cannot be ignored when correlated with a natural and continuous area of dispersal:

	calyx-tube (mm.)	teeth (mm.)	proportion	banner (mm.)
var. *Lambertii*	6.25	2.14	1:2.94	16.95
var. *articulata*	7.59	1.47	1:5.16	21.39

The plant collected ''in territorio Texano'' by von Neuwied and mentioned by Bunge (Gen. Oxytr., 85) as probably of a species distinct from *O. Lambertii* must doubtless belong to var. *articulata.*

18c. **Oxytropis Lambertii** Pursh var. **Bigelovii** Gray

Oxytropis Lambertii Pursh var. *Bigelovii* Gray, Proc. Amer. Acad., 20:7. 1884. *Aragallus Bigelovii* (Gray) Greene, Pittonia, 3:212. 1897. *Astragalus Lambertii* var. *Bigelovii* (Gray) Tidestr., Proc. Biol. Soc. Wash., 50:19. 1937.

Astragalus intermedius Jones, Proc. Calif. Acad. Sci., II, 5:656. 1895, pro parte, quoad char. fruct.

Aragallus Metcalfei Greene, Proc. Biol. Soc. Wash., 18:12. 1905.

Aragallus Knowltonii Greene, op. cit., 19. 1905.

Aragallus patens Rydb., Bull. Torr. Club, 34:421. 1907. *Oxytropis patens* (Rydb.) A. Nels., Univ. Wyo. Pub. Bot., 1:114. 1926.

Oxytropis bilocularis A. Nels., op. cit., 111. 1926.

Pilose throughout, the pubescence everywhere appressed, or the scapes, petioles and calyces bearing some loose hairs, the herbage silky-canescent or greenish; stipules permanently silky or at length glabrate dorsally and merely ciliate; leaves spreading or erect, (2.5) 5–17 (24) cm. long, with (3) 7–15 (19) ovate, elliptic, broadly lanceolate or very rarely (in some leaves) linear leaflets 7–20 (32) mm. long, (2.5) 3–8 mm. wide; scapes erect, (4) 7–25 (35) cm. long; racemes 8–28 (45) -flowered, commonly elongating and the axis (3) 5–16 cm. long in fruit; flowers usually spreading at a wide angle; calyx (6.5) 8–10 mm. long, the white-silky tube (4.5) 5–7 (7.5) mm., the subulate teeth (1.5) 2–4 mm. long; petals brilliant pink-purple, exceptionally white or polychrome (varying between white and purple in a colony); banner (15) 18–23 (25) mm. long, (6) 8–11 mm. wide; wings (13.5) 15–20 (22) mm. long, the emarginate blades obliquely dilated and (4) 5–7 (8) mm. wide near apex; keel (12) 13–16 (17) mm. long; pod sessile or shortly stipitate, erect or spreading at maturity, narrowly lance-acuminate in outline, the body 15–25 mm. long, 2.5–5 (6) mm. in diameter, tapering into a slender, commonly straight beak about 5 mm. long, the valves thinly coriaceous, scarcely rigid, strigose or strigulose, often glabrate at length, the partition usually complete, 0.8–1.9 mm. wide. *Type* collected by J. M. Bigelow, in 1853, "on the Canadian River, in Colorado?" actually in Guadalupe or San Miguel County, New Mexico[17]; Upper Canadian, *Bigelow in 1853* (GH, US)!

Distribution: Sandy plains, sagebrush mesas, mountainsides, rarely on sand-dunes, to the south commonly in yellow pine-forest, from southwestern Wyoming southward, mostly in the foothills of the Rocky Mountains on both slopes of the Divide to central New Mexico, west to the Wasatch, Utah, and the Mogollon system of central and southern Arizona. Map 10.

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[17] The Whipple Expedition entered New Mexico from the Texas Panhandle on September 30, 1853, at a point east or northeast of Tucumcari (cf. Standl., Cont. U. S. Nat. Herb., 13:148) and travelled due west to Albuquerque. On September 26, the date given on Bigelow's label, the company camped at Sheep Spring, a day's journey to the east of Anton Chico, a settlement on the Pecos River in northwestern Guadalupe County. The type of var. *Bigelovii* must have been encountered on or near the Canadian-Pecos divide.

Representative specimens: WYOMING. Head of Pole Creek, Albany County, *A. Nelson 1320* (CAS, NY, WTC). Fort Steele, Carbon County, *Tweedy 5633* (NY). UTAH. West Tavaputs Plateau, 20 mi. n. of Wellington, *Maguire 18529* (GH, NY). S. of Needle Rock, Monument Valley, *Holmgren 3232* (GH, NY, WTC, WTU). Soldier Summit, Wasatch County, *Jones 5600* (NY, POM, WTC). COLORADO. Plains and foothills near Boulder, Boulder County, *Tweedy 5164* (NY, type of *Aragallus patens).* Cuchara River below La Veta, Las Animas County, *Rydberg & Vreeland 5999* (NY). S. of Axial, Moffat County, *Ripley & Barneby 9161* (CAS). ARIZONA. Miller Peak, Huachuca Mts., Cochise County, *Goodding 2411* (GH, NY, POM, isotypes of *O. bilocularis).* Jhu's Pass, Chiricahua Mts., Cochise County, *Blumer 1950* (GH, NY, partly white-flowered). San Francisco Mts., Coconino County, *Knowlton 44* (US, type of *Aragallus Knowltonii).* NEW MEXICO. Mimbres to Santa Rita, *Wright 1006 in 1851* (GH, NY). Sawyer's Peak, Grant County, *Metcalfe 1079* (US, type of *O. Metcalfei,* CAS, GH, POM). 19 mi. w. of Santa Fe, Santa Fe County, *A. & G. Heller 3621* (NY, OB, POM, US, WTC).

The var. *Bigelovii* is nearly as variable as var. *Lambertii,* presenting a series of fluctuating forms. The northern and southern extremes, which approximate to *O. patens* and *O. bilocularis,* are fully intergradient. Most of the material from southern Wyoming and adjacent Colorado is characterized by short, strongly dimorphic, spreading leaves, and the sessile pod may be either erect or spreading, the latter condition being supposedly characteristic of *O. patens.* These are plants flowering in spring and early summer on high, cold plateaux and small areas of elevated prairie on the flanks of the Rocky Mountains, and the habit is no doubt an expression of the environment and season. Further south an exactly similar form occurs sporadically in exposed situations (cf. *Jones 4050,* from Flagstaff, Ariz., POM). In the mountains of New Mexico and Arizona the prevailing form is more robust, with erect and ample, less strongly dimorphic leaves, and longer racemes *(Aragallus Knowltonii, A. Metcalfei,* and *O. bilocularis).* This flowers in the period of summer and autumn rains, and the legume is commonly erect and shortly stipitate. But individuals as robust occur right through the variety's range, as Nelson inferred in the range attributed to *O. bilocularis,* and the pod may be either stipitate or strictly sessile, spreading or erect, in plants otherwise alike. We have an example of var. *Bigelovii* from Gunnison, Colorado *(Ripley & Barneby 7159)* which in its short, semi-spreading leaves and divaricate, stipitate pod neatly combines the salient features of *O. bilocularis* and *A. patens.*

Nelson's attempt to segregate from *O. Lambertii* a species, *O. bilocularis,* on the basis of a complete septum in the pod, was ill considered. The pod of *O. Lambertii* as a whole is bilocular in the fresh state, or so nearly so that the difference is hardly of practical importance. In the mature or artificially dried fruit some differences do appear. When the valves are fleshy, as is the case in var. *Lambertii* and var. *articulata,* the inner wall commonly shrinks in ripening, thereby leaving a gap between the dorsal suture and the free edges of the partition, when the pod may appear semibilocular. Structurally, however, this is not different from the thinner-walled pod of var. *Bigelovii,* where the shrinkage is less or almost none, and contact between the partition and the suture is maintained until dehiscence. Moreover the degree of shrinkage even in the fleshy pod is uncertain and variable, and perfectly typical var. *Lambertii* from Kansas (e. g. *Rydberg & Imler 702,* NY), from far outside the range attributed by Nelson to *O. bilocularis,* sometimes has a mature, fully bilocular legume.

Bigelow's plant represents an uncommon and marginal phase of var. *Bigelovii* as here circumscribed. The leaflets are linear-lanceolate and five to ten times longer than wide, in fact of the type commonly associated with var. *Lambertii.* But the pod is thinly coriaceous and stipitate, as found only in the Cordilleran populations of the species. Several collections from San Miguel, Colfax, and Mora counties in New Mexico resemble it in leaflet-outline, and it seems to belong to a minor variant prevalent in this region and perhaps intergradient toward var. *Lambertii.*

The variety has passed in floras under many names. Wooton and Standley (Cont. U. S. Nat. Herb., 19: 371) referred most of the taller New Mexican material to *O. pinetorum (O. sericea* var. *sericea).* Rydberg (Fl. Rocky Mts., 521), misled by the superficially similar dimorphism of the leaves, reduced his *A. patens,* here included in var. *Bigelovii,* to *A. dispar (O. campestris* var. *dispar).* The more silvery states have been called *O. sericea* (but not of Nuttall), until Kearney and Peebles (Fl. Pl. Ariz., 490) pointed out the trivial nature of vesture as a criterion in *O. Lambertii.*

19. **Oxytropis Maydelliana** Trautv.

Oxytropis Maydelliana Trautv., Act. Hort. Petrop., 6:16. 1879.

Oxytropis campestris ξ melanocephala Hook., Fl. Bor.-Amer., 1:147. 1834.

Oxytropis campestris ε glabrata Hook., loc. cit., 1834. *O. glabrata* A. Nels., Univ. Wyo. Pub. Bot., 1:117. 1926.

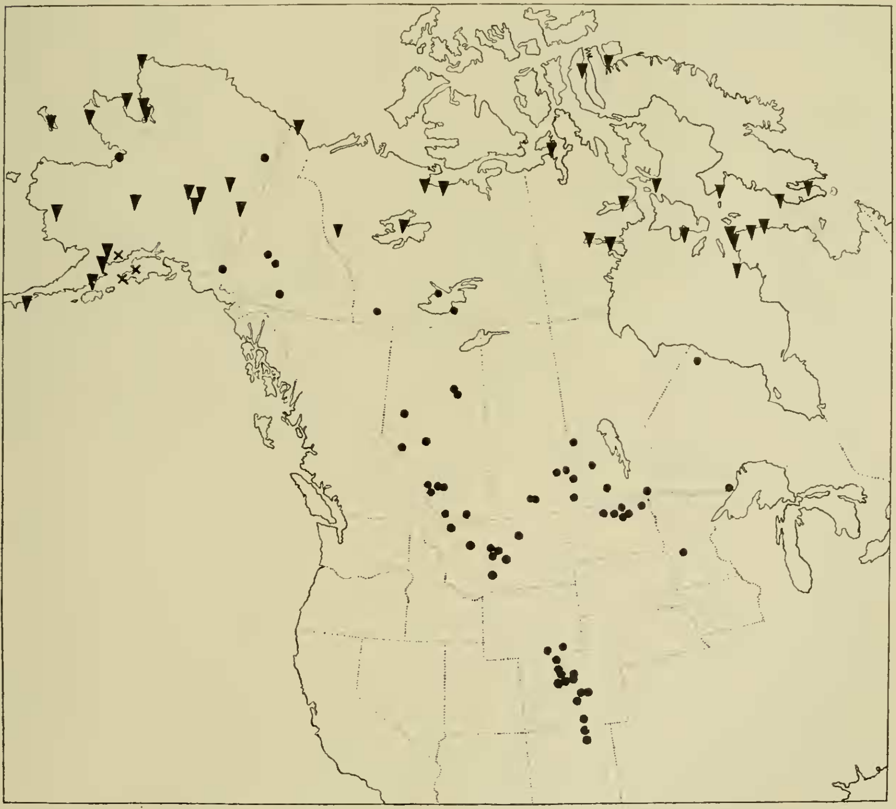
Cespitose, from a stout pluricipital taproot, the crowns clothed below with a thatch of marcescent stipules and leaf-bases; stipules lanceolate, (10) 14–21 mm. long, at first yellowish-brown but early becoming purplish-chestnut color (or at length nearly black), stiff and chartaceous, glabrous or nearly so dorsally, the deltoid to lance-caudate free blades 4–11 mm. long, hispid-ciliate with yellowish hairs often mixed with a few clavate processes; leaves unequal in length but not strongly dimorphic, 4–14 cm. long, the petioles either thinly appressed-pilose or more or less hirsute, particularly at base; leaflets (9) 11–17, ovate to lanceolate, elliptic or oblong, obtuse or acute, green and somewhat fleshy (becoming rugulose when dry), 4–13 mm. long, sparingly pilose, especially near the margins above and on the midrib beneath, occasionally nearly glabrous; scapes erect, thinly villous-hirsute throughout or only below the inflorescence, 3.5–15 cm. long; racemes subcapitate or oblong, densely 5–10-flowered, the flowers and pods erect, the axis becoming 1–3 cm. long in fruit; bracts lanceolate, mostly acute, 4–10 mm. long, pilose dorsally and ciliate, commonly with fuscous hairs; calyx shaggy-pilose with all dark or mixed dark and pale hairs, 5–6.5 mm. long, the tube 4–5 mm., the subulate-deltoid teeth 1–2 mm. long, separated by rather wide and obtuse sinuses; petals pale yellow, immaculate; banner oblanceolate, or the blade obovate, the whole 14–16.5 mm. long, 5–7 mm. wide; wings 12–14 mm. long, the oblong or oblong-triangular blades 7–9.5 mm. long, 2.5–3.5 mm. wide near the obliquely truncate to deeply emarginate apex; keel 11–12.5 mm. long; pod ovoid or ellipsoid, tumid, the body 10–14 mm. long, 4–5 mm. in diameter, abruptly or gradually contracted into a narrow, straight, or divaricate beak 4–6 mm. long, sulcate ventrally, the valves membrano-chartaceous, pilosulous with dark and pale hairs, the partition about 1 mm. deep, apparently never complete; seeds brown, nearly smooth, 1.6–1.8 mm. in diameter. *Type* collected by Baron G. von Maydell, in 1869, ". . . in tractu fluvium Anadyr inter et latus meridionale montium jugi a fluvio hoc septentrionem versus siti . . .," i. e. eastern Siberia.

Distribution: Arctic and subarctic shores, descending to latitude 62°, Ungava Peninsula, Quebec, to Baffin Island, west to coastal and interior Alaska, Chukches Peninsula, and Kamtchatka. Map 11.

Representative American specimens: ALASKA. Point Hope, *Mason in 1931* (CAS, GH). Polychrome Pass, McKinley Park, *A. & R. Nelson 3816* (GH, NY, WTC, WTU). Katmai region, Alaska Peninsula, *Hagelbarger 78* (US). MACKENZIE. Coppermine, *Dutilly in 1934* (GH). Great Bear Lake, *Preble 287* (US). FRANKLIN. Gjöa Harbor, King William I., *Lindstrom in 1904* (NY). Lake Harbor, Baffin I., *Polunin 2273* (GH), *2287* (NY). KEEWATIN. Wager Inlet, Hudson Bay, *Macoun 79103* (GH, NY). QUEBEC. Erick Cove, Hudson Strait, *Low 22991* (GH, NY, US).

Oxytropis Maydelliana, distinctive by reason of its stiff, glabrous, purple-brown stipules, its green, somewhat fleshy herbage, and yellow flowers, is apparently the commonest species of *Oxytropis* in high latitudes and the most widespread, extending from Hudson Strait and Baffin to Alaska and northeastern Siberia. The forty-odd collections seen are remarkably uniform in appearance and detail. The species has been amply and admirably treated by Fernald (Rhodora, 30:142), Hultén (Fl. Kamtch., 3:106, fig. 12, a, b, c.) and Polunin (Bot. Canad. E. Arct., 291), to whose accounts the reader is referred for fuller information.

Oxytropis campestris ε glabrata, to which Hooker ascribed the character "foliis glabriusculis subsucculentis" and a northern but imprecise station (with var. *melanocephala:* "Bear Lake to the Arctic Shores and Islands"), is referred here on the basis of a specimen in the Gray Herbarium labelled "*O. campestris ε glabrata,* from Dr. H[ooker], 1832, Amer. Bor.," and presumably authentic for the variety. The point should however be checked against the Hooker Herbarium, since Hultén (Fl. Alaska & Yukon, 1098) states that the authentic var. *glabrata* seen by him was a form of *O. gracilis;* and it was in that sense that Rydberg (Fl. Prair. & Pl., 485) used the term *O. glabrata.* The plant that Nelson had in mind *(Gorman 1365,* WYO) when he transferred var. *glabrata* to the specific category is, however, *O. Maydelliana.* It seems probable that the unnamed variety of *O. campestris* described by Chamisso (Linnaea, 6:546, 1831) from St. Lawrence Strait and Cape Espenberg in Alaska is to be identified with *O. Maydelliana* also. Chamisso drew attention to the persistent stipules being "fuscis carboneis," which applies well to the species; but other details are less convincing.



Map 11. American range of *Oxytropis Maydelliana* ▼; range of *O. splendens* (Alaskan stations after Hultén) ●; and of *O. campestris* var. *varians,* the "*alaskana*" form **X**.

20. **Oxytropis arctica** R. Br.

Oxytropis arctica R. Br., Parry's First Voy., Append., 9:278 (Chlor. Melvill., 209, in R. Br., Collected Works). 1824. *Astragalus arcticus* (R. Br.) Spreng., Syst., 4^2:288. 1827. *Oxytropis uralensis δ arctica* (R. Br.) Ledeb., Fl. Ross., 1:594. 1842. *Spiesia arctica* (R. Br.) O. Kze., Rev. Gen., 205. 1891. *Aragallus arcticus* (R. Br.) Greene, Pittonia, 3:211. 1897.

Oxytropis arctica α subumbellata Hook., Parry's Second Voy., Append., 4:396. 1825.

Oxytropis Roaldi Ostenf., Vasc. Pl. Arct. N. Amer. Gjöa Exped., 54, Pl. 3. fig. 16. 1910.

Oxytropis coronaminis Fern., Rhodora, 30:151, Pl. 175. 1928. *Astragalus coronaminis* (Fern.) Tidestr., Proc. Biol. Soc. Wash., 50:19. 1947.

Cespitose, from a pluricipital taproot, the divisions of the caudex clothed in a thatch of marcescent petioles and stipules; herbage densely villous-pilose, the leaflets sometimes thinly so and greenish, the vesture commonly fulvescent in age; stipules 6–12 mm. long, pale and fragile, at first connate opposite the petiole, densely pilose throughout or the tips rarely glabrate in age, the deltoid to deltoid-acuminate free blades 3–6 mm. long, their margins bristly-ciliate and beset with clavate processes; leaves 1.5–9 cm. long, the petioles loosely pilose; leaflets 11–19 (21), ovate to narrowly oblong or elliptic, 2–11 mm. long, all usually solitary and opposite, but a few sometimes geminate in unequal pairs; scapes ascending or erect, 1.5–13 cm. long, villous-pilose or pilosulous, at least below the inflorescence, the hairs there commonly fuscous; racemes subcapitately 2–10-flowered, becoming looser, the axis up to 12 mm. long in fruit; bracts linear-lanceolate, 3–9 mm. long, shaggy-pilose dorsally, the hairs mostly black; pedicels becoming up to 4 mm. long in fruit; calyx shaggy-pilose with dark or mixed dark and light hairs, the cylindro-campanulate tube 5–9 mm., the deltoid to linear-lanceolate teeth 1–5 (6) mm. long; petals purple; banner obovate, sometimes very broadly so, 15–21 (''27'') mm. long, 6.5–13 mm. wide; wings 12.5–17 mm. long, the blades 9–12 mm. long, 4.5–6 mm. wide near apex; keel 11–15 mm. long; pod sessile or nearly so, the body oblong-ellipsoid, 10–15 mm. long, 5–7 mm. in diameter, obtuse at base, contracted upward into a nearly straight, acuminate beak 5–10 mm. long, slightly obcompressed, deeply sulcate ventrally and obscurely so dorsally, the valves thinly chartaceous, pilosulous with mixed black and white hairs, the ventral suture produced inward as a partition about 1 mm. wide, the dorsal somewhat prominent within but not septiferous; seeds pale brown, 1.5–1.8 mm. in diameter. *Type* collected on Admiral Parry's First Voyage, on Melville Island.

Distribution: Arctic shores, inland in Alaska only, from the south shore of Rae Isthmus at about 87° W., westward through coastal Mackenzie and the islands of the Polar Sea to the upper Yukon and Seward Peninsula, Alaska; reported from Siberia. Map 12.

Representative American specimens: ALASKA. Teller Reindeer Station, Port Clarence, *Walpole 1522* (US). Sheenjek Valley, *Mertie in 1926* (US). YUKON. Herschell I., *Lindstrom in 1906* (NY, isotype of *O. Roaldi)*. MACKENZIE. Arctic sea-coast, *Richardson* (GH, type of *O. coronaminis* (GH). Epworth Harbor, Coronation Gulf, *Cox & O'Neill 395* (NY). Kent Peninsula, *Hoare 119027a* (GH, NY). FRANKLIN. Melville I., *Sabine* (GH). Winter Harbor, Melville I., *MacMillan 77294* (GH, NY). Repulse Bay, *C. F. Hall in 1869* (US).

Oxytropis arctica is apparently the only purple-flowered eglandular species of the *O. campestris* type native to the American segment of the Arctic Circle. The forms of *O. viscida* (var. *hudsonica* and var. *subsucculenta)* from the same range, even when their characteristic viscidity becomes obscure in drying, are distinguished by their somewhat succulent leaflets, dorsally glabrous bracts, and nearly always glabrescent stipules. The densely pilose *O. arctica,* with its fragile, permanently pilose stipules and shaggy bracts, is quite variable in stature, length of calyx-teeth and amplitude of the petals. Porsild (Sargentia, 4: 51, 1943) has pointed out that *O. coronaminis* and *O. arctica* are conspecific, and doubtless they are correctly interpreted as large- and small-flowered phases of one species. When Fernald described *O. coronaminis* he was evidently not clear as to the true identity of *O. arctica,* for he defined it as having 11–17 leaflets, black-villous bracts, and vexillum 4–7 mm. broad, yet figured a plant (Rhodora, 30, Pl. 172, upper fig.) with 21–23 leaflets and glabrous bracts, and cited a specimen from Melville Island *(Sabine,* GH) with banner at least 8 mm. broad. The plant photographed is a specimen of *O. viscida* var. *hudsonica;* that cited represents a reduced state of *O. arctica.* Simultaneously Fernald identified the MacMillan gathering from Melville Island, which closely resembles Sabine's plant, as "depauperate" *O. coronaminis.* In his second revision (1884) Gray placed both the little Sabine plant and Richardson's more robust collection from coastal Mackenzie in *O. arctica,* a disposition which is confirmed by study of additional material and by Porsild's judgment already mentioned.

The reduction of *O. Roaldi* is more difficult, though seemingly inevitable. It was recommended by Porsild, and effected by Hultén (Fl. Alaska & Yukon, 1105, map 834. 1947) in the sense that he considered *O. coronaminis* a synonym of *O. Roaldi.* In contrast to the loosely pilose *O. arctica-coronaminis,* with racemes of 2–5 large flowers (banner 8–17 mm. wide) and calyx-teeth 2–6 mm. long, the plants of Herschell Island, i. e. *O. Roaldi* in the strictly typical aspect, have subappressed-silky herbage, 7–9-flowered racemes of smaller flowers (banner 6–7 mm. wide), and calyx-teeth 1–1.5 mm. long. Fernald brought out all these points when establishing *O. coronaminis,* yet at the same time identified as his new species a collection from Coronation Gulf, *Cox & O'Neill 395.* The part of this gathering seen by the writer has a 5-flowered raceme, calyx-teeth only 1.5 mm. long, banner less than 1 cm. broad, and is therefore quite at variance with *O. coronaminis* as described by Fernald, and closely resembles isotypes and topotypes of *O. Roaldi.* Holm's figure of *O. Roaldi* (Rep. Canad. Arct. Exped., 5: 17A, pl. 8, fig. 2. 1921) which Fernald thought to be modelled on specimens of *O. coronaminis* with error in flower-number, seems to be an accurate delineation of *Cox & O'Neill 395.* Obviously then *O. Roaldi* and *O. arctica* both occur on Coronation Gulf, a suspicious circumstance in view of their close essential similarity. It might be thought that *O. Roaldi* exists as a more westerly ranging race, with at least tendencies toward smaller and more numerous flowers. But plants from the easternmost known station on Rae Isthmus have about 6 flowers of medium size (banner about 9 mm. wide), whereas those from Port Clarence on Behring Strait have subumbellate, 3–4-flowered racemes of broad showy flowers supposedly unique to *O. coronaminis.* At least until fuller data becomes available it is best to consider *O. arctica, O. coronaminis* and *O. Roaldi* as minor variants of a variable species.

It has been suggested by Polunin (Bot. Canad. E. Arct., 290. 1940, sub *O. terrae-novae)* that the name *O. artica* should be discarded, owing to the difficulty in determining which arctic *Oxytropis* Robert Brown had in mind. The detailed description, however, applies to the species here treated and to none other of the region. Moreover, *O. arctica* is still the only species of the genus positively known by modern collections from Melville Island, for, as Polunin himself has pointed out, specimens of *O. Maydelliana* and *O. arctobia (O. nigrescens* var. *uniflora)* so labelled were actually collected on Parry's Second Voyage, which did not reach the Polar Sea. Brown did have both *O. arctica* and *O. nigrescens* var. *uniflora,* and clearly distinguished the latter in the addenda to Chloris Melvilleana as "varietas notabilis . . . scapo saepe unifloro . . ." Since *O. arctica* and the var. *uniflora* are the only densely silky, purple-flowered species of *Oxytropis* in Arctic America, and since Brown explicitly distinguished them, the identity of *O. arctica* seems firmly established.

No Asiatic material of the species has been available, so that it is impossible to confirm the identity of *O. uralensis* var. *arctica* of Ledebour, or its reported occurrence on the lower Yenisei and Taimyr Peninsula, as quoted by Hultén (op. cit., 1106). Hultén states however that corresponding specimens "agree completely with large-flowered Alaskan *O. Roaldi.*"

The collection from Port Clarence, Alaska, cited above *(O. sewardensis* Wight ex Hult., op. cit., 1105, nomen) is remarkable in that the larger individual plants bear some leaves with a few paired leaflets, thereby recalling *O. Belli* of the eastern Arctic. It is a matter of conjecture whether the *O. Belli* reported by Schischkin (Fl. U. R. S. S., 13: 196. 1948) from Wrangel Island, not so very far to the northwest, may not refer to a similar form of *O. arctica.*

21. **Oxytropis Belli** (Britt.) Palib.

Oxytropis Belli (Britt.) Palib., Bull. Soc. Bot. Genève, II, 2:19. 1910. "*Spiesia Oxytropis Belli*" Britt. ap. Macoun, Canad. Rec. Sci., 6:148. 1894. *Aragallus Belli* (Britt.) Greene, Pittonia, 3:212. 1897. *Astragalus Belli* (Britt.) Tidestr., Proc. Biol. Soc. Wash., 50:18. 1937.

Cespitose from a pluricipital taproot, villous-pilose with fine, mostly tortuous hairs which become yellow when dry, the herbage canescent or greenish; stipules membranous, fragile, 10–20 mm. long, pilose dorsally, the deltoid-acuminate to narrowly acuminate free blades 3–10 mm. long, often glabrate at length, their margins ciliate with long pilose bristles and a few clavate processes; leaves 4–13 (17) cm. long; leaflets disposed in 7–10 fascicles of 3–4 together, the lowest on the rachis sometimes merely opposite or scattered, all ovate, oblong-ovate or lanceolate, obtuse or acute, 3–9 mm. long, villous-pilose on both faces, rarely glabrescent above; scapes about equalling the leaves, erect, densely villous-pilose with pale and (especially below the inflorescence) admixed fuscous hairs; racemes (2) 4–8 (10)-flowered, subcapitate at anthesis, the axis becoming 1–2 (4) cm. long in fruit; bracts narrowly lanceolate, 5–9 mm. long, densely shaggy-pilose dorsally, mostly with dark hairs; pedicels 1–1.5 mm long; calyx deeply campanulate, 9–10 mm. long, densely shaggy-pilose (dark hairs predominating), the tube 6–7.5 mm., the teeth 2.5–3 mm. long; corolla "pinkish-violet"; banner 18–21 mm. long, obovate-oblanceolate, 6–8 mm. wide; wings about 15 mm. long, their blades about 9 mm. long, somewhat dilated upward, 4–6 mm. wide near the oblique, emarginate apex; keel 13–14 mm. long, the straight or slightly declined appendage less than 1 mm. long; pod long-persistent on the axis, erect, sessile, oblong-ellipsoid, 12–20 mm. long, 4.5–7 mm. in diameter, slightly obcompressed and sulcate along both sutures, abruptly contracted into a slender straight or somewhat divaricate beak 3–5 mm. long, the valves chartaceous, densely short-villous with fuscous and occasionally some longer, pale hairs, the partition 1.5–2.5 mm. wide, extending across the cavity to the impressed and sometimes vestigially septiferous dorsal suture; seeds brown, 1.8–2 mm. in diameter. *Type* collected by R. Bell, in 1884, on Digges Island; *Bell, 15 September 1884* (NY, fragments, isotype; US mixed with *O. Maydelliana)!*

Distribution: Rocky or turfy shores of bays and islands about northern Hudson Bay; reported from Wrangel Island, Siberia[18]. Map 12.

Representative specimens: KEEWATIN. Ranken Inlet, *Macoun 79106* (GH, NY, OB). Fullerton, Hudson Bay, *Macoun 79105* (GH, NY). Chesterfield Inlet, *Burwash 119028* (GH, NY).

Oxytropis Belli is distinguished from our other species by the combination of pseudo-verticillate leaflets and relatively large violet flowers in short racemes. In the fragile stipules and quality of the vesture, as well as in the corolla and legume, it resembles *O. arctica,* and the two species seem more closely related to each other than to any other American species.

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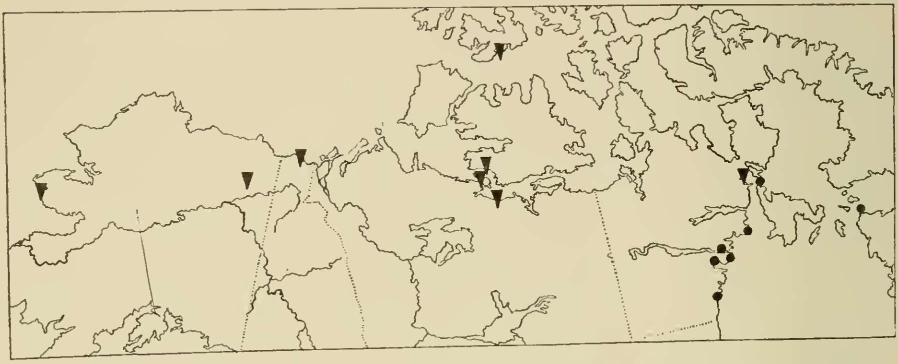
[18] Cf. discussion of the preceding species, *O. arctica*.



Map 12. Ranges of *Oxytropis arctica* (in America) ▼; and of *O. Belli* ●.

The history of *O. Belli* has been admirably set forth by Fernald (Rhodora, 30: 150. 1928), to whose account Polunin (Bot. Canad. E. Arct., 295. 1940) and Porsild (Sargentia, 4: 52. 1943) have added valuable data from field-experience.

22. **Oxytropis splendens** Dougl.

Oxytropis splendens Dougl. ex Hook., Fl. Bor.-Amer., 1:147. 1834. *Spiesia splendens* (Dougl.) O. Kze., Rev. Gen., 207. 1891. *Aragallus splendens* (Dougl.) Greene, Pittonia, 3:211. 1897. *Astragalus splendens* (Dougl.) Tidestr., Proc. Biol. Soc. Wash., 50:18. 1937.

Oxytropis splendens α vestita Hook., Fl. Bor.-Amer., 1:148. 1834.

Oxytropis splendens β Richardsonii Hook., loc. cit., 1834. *O. oxyphylla* sensu Richards., Bot. Append. Franklin's Journ., 745 (in reprint, p. 28). 1823; non DC. *Aragallus Richardsonii* (Hook.) Greene, Pittonia, 4:69. 1899. *Oxytropis Richardsonii* (Hook.) K. Schum., Just's Jahresb., 27^1:496. 1901; Woot. & Standl., Cont. U. S. Nat. Herb., 19:370. 1915, as "comb. nov." *Astragalus splendens* var. *Richardsonii* (Hook.) Tidestr., Proc. Biol. Soc. Wash., 50:18. 1937.

Aragallus caudatus Greene, Pittonia, 4:69. 1899. *Oxytropis caudata* (Greene) K. Schum., Just's Jahresb., 27^1:496. 1901, as "*caudatus.*"

Oxytropis splendens fma. *Nelsonii* Gand., Bull. Soc. Bot. France, 48:xvii. 1901.

Oxytropis splendens fma. *strigosa* Gand., loc. cit., 1901.

Aragallus galioides Greene, Proc. Biol. Soc. Wash., 18:16. 1905.

Cespitose from a pluricipital taproot, copiously silky-villous throughout, the vesture sometimes appressed or rather thin on the leaflets, but always villous-hirsute about the bases of the petioles and scapes, the hairs fulvescent in age; stipules membranous, fragile, silky-pilose dorsally, the deltoid to deltoid-acuminate free blades 5–12 mm. long; leaves (5) 7–26 cm. long, sometimes strikingly dimorphic, the primary ones then with shorter and broader leaflets, the petioles (1) 2–9 cm. long; leaflets numerous, 2–4 of unequal length disposed at a point in 7–15 fascicles diminishing upward along the rachis, a few sometimes solitary, opposite or scattered, all elliptic, narrowly to broadly lanceolate or oblong, acute or acutish (very rarely obtuse), 3–20 mm. long, canescent on both faces or rarely greenish above; scapes erect, 10–36 cm. long, usually well surpassing the leaves; racemes ovoid to narrowly oblong, (9) 12–35-flowered, dense at first anthesis (or with a few remote, scattered flowers below), the axis elongating and (3) 4–16 cm. long in fruit; bracts linear or lanceolate, 5–17 (23) mm. long, densely silky-pilose dorsally and ciliate; calyx silky-villous with pale, or some darker hairs, 8–10 mm. long, the tube 5–6.5 mm., the teeth (1.5) 2–4 mm. long; corolla rose-color or carmine, drying violet; banner oblanceolate to narrowly obovate, 12.5–16 mm. long, 4.5–6 mm. wide, obscurely emarginate; wings 10.5–12 mm. long, the blades oblong, 6.5–8 mm. long, scarcely dilated upward, 2.5–3 mm. wide near the truncate-emarginate apex; keel 10–11.5 mm. long, the appendage minute or up to 1 mm. long, straight or curved; pod minutely stipitate, ovoid-ellipsoid or oblong, 10–17 mm. long, 3–5 mm. in diameter, the body sulcate on both sutures and somewhat obcompressed, passing gradually or abruptly into an erect or somewhat divaricate beak 3–4 mm. long, the valves thinly chartaceous, densely subappressed-pilose, the partition 0.7–1.5 mm. wide, the dorsal suture sometimes raised within and bearing a vestigial septum; seeds numerous, dull, chestnut or umber, 1.5–1.8 long. *Type* collected by David Douglas, ''on the limestone rocks of the Red River, and south toward Pembina,'' presumably southern Manitoba.

Distribution: Meadows, river-banks, prairies and mountain parks, in rich and often moist soils, Alaska to northern Ontario, Minnesota, and along the Rocky Mountains, chiefly on the Atlantic slope, to northern New Mexico. Map. 11.

Representative specimens: Without locality, *Richardson* (NY ex herb. Hook.; GH, as ''*O oxyphylla* of Richardson,'' isotypes of *O. splendens β Richardsonii).* YUKON. Fort Selkirk, *Gorman 1057* (POM, US). ALBERTA. Peace Point, *Raup 2733* (NY, UC, US). Bow River near Banff, *McCalla in 1899* (US, type of *Aragallus galioides), No. 2129* (NY, WTU). SASKATCHEWAN. Spy Hill, *Macoun & Herriott 70802* (CAS, GH, ND, NY, POM). Moose Jaw, *Macoun 13957* (ND, type of *Aragallus caudatus).* MANITOBA. Red Deer Lakes, *J. Macoun 454* (NY). ONTARIO. Sleeping Giant, Thunder Bay Distr., *Taylor, Losee & Bannan 2194* (GH). MONTANA. Castle City, Meagher County, *C. L. Hitchcock 15918* (RB, WTC, WTU). NORTH DAKOTA.

Butte, Benson County, *Lunell in 1907* (NY). Minnesota. Chippewa River, *Dr. Suckley* (GH). Wyoming. Pole Creek, Albany County, *A. Nelson 1391* (NY, OB, US). Colorado. Hot Sulphur Springs, Grand County, *Shear & Bessey 4314* (NY, US). Twin Lakes, Lake County, *Clokey 3592* (CAS, NY, POM, WTC). New Mexico. Winsor's Ranch, San Miguel County, *Standley 4064* (NY).

Oxytropis splendens, well marked by its cylindric or at first clavate spike of smallish purple flowers, numerous whorled leaflets and fine silky-villous vesture, is rather a stable species. Variation is conspicuous only in length of the bracts and in density of the pubescence, and the segregates which have been proposed have from early times been based on these characters. Hooker recognized from the first a typical *α vestita,* "valde hirsuto-sericea, bracteis hirsutissimis calyce multo longioribus," described from Douglas's Red River plants, and a *β Richardsonii,* "minus hirsuta, bracteis vix longitudine calycis," collected between the Saskatchewan River and the Rocky Mountains. It has long been apparent that these criteria of bracts and pubescence do not always coincide, witness plants from Severn River, Ontario *(Macoun in 1886,* NY), glabrescent and bracteose, and much material from the Rocky Mountains with the opposite combination; so that var. *Richardsonii* can at best be distinguished by but one, and that a fluctuating and minor character. Greene (Pittonia, 4: 69) declared that var. *Richardsonii* differed also from *O. splendens* in "much smaller flowers," but no correlation between flower-size and length of bracts can be made out in material which has accumulated since. It must be admitted, however, that the long-bracted form is more frequent on the northern plains, whereas most cordilleran plants are short-bracted. But exceptions (cf. *Tweedy 5630,* from Colorado; *A. Nelson 1391* from Wyoming: as robust and bracteose as anything from Manitoba) and intermediate states are numerous, and var. *Richardsonii* is probably no more than an occasional response to environment with little claim to systematic recognition.

The species proposed by Greene, each from a single collection, are likewise inconsiderable modifications. The type of *A. caudatus* represents the extreme bracteose condition (bracts up to 23 mm. long, far surpassing the calyx) and seems to correspond exactly with the original *O. splendens* of Douglas. It was reduced even by Rydberg to the species. *Aragallus galioides* was maintained by Rydberg as having narrower and less silky leaflets, but the type, although rather slender and green, perhaps from shady habitat, is in no other way remarkable. Gandoger's formae are equally unimportant.

In his treatment of *O. splendens,* Bunge mentioned an "*O. micans,*" said to differ only in "carinae mucro paullo longior" (Gen. Oxytr., 137. 1874). No further reference to this name has been traced, and it was perhaps found on an herbarium sheet; at least it seems never to have been published.

INTRODUCED SPECIES

Oxytropis riparia Litv.

Oxytropis riparia Litv., "Sched. Herb. Fl. Ross., 6:98. 1908"; Vassil. & B. Fedtsch. in Fl. U.R.S.S., 13:42. 1948.

Astragalus Rubyi Green & Morris, Jour Amer. Soc. Agron., 27:546, 549, figs. 1, 2. 1935, *nomen provis.*

Coarse, diffuse, strongly caulescent perennial herb, green but minutely strigose; stipules foliaceous, 5–10 mm. long, united through about half their length opposite the petiole; leaves subsessile, with 11–17 broadly oblanceolate, acute or acutish leaflets 1–3 cm. long; peduncles far surpassing the leaves; racemes lax, subsecund, the axis becoming 3–20 cm. long in fruit; flowers small, purplish, the banner about 6 mm. long; calyx white-strigose, the tube 2–2.5 mm., the teeth about 1.5 mm. long; pod pendulous, stipitate. the stipe 1–2.5 mm., the narrowly oblong body 1.5–2 cm. long, 4–5 mm. in diameter, sulcate ventrally, the valves papery, strigulose, not inflexed.

Distribution: Native to Russian Turkestan (Kara-Kum, Turkmenistan; Amu-Darya River); introduced and cultivated in southwestern Montana.

In 1930 or thereabouts a strange leguminous plant appeared on ranches near Waterloo and Twin Bridges, in the valleys of the Ruby and Jefferson rivers in Madison County, Montana. According to the botanists of the State College, Bozeman, it formed lush growths on alkaline bottom-lands and provided palatable forage similar to alfalfa. Analysis showed a relatively high phosphorus content for a crop grown on alkaline soil, and suggested that it might become useful on otherwise barren lands.

Only two specimens purporting to represent *Astragalus Rubyi* have been seen: "secured from Mr. Morris, Bozeman," distrib. *A. & R. Nelson 3184* (UC); Fargo, Montana, cultivated, *O. A. Stevens 291* (UC), and no authentic Russian *O. riparia* has been available for comparison. The present identification is based therefore on the ample description in the Flora of the Soviet Union[19], which seems to fit our plant down to the last detail.

Oxytropis riparia, placed in sect. *Mesogaea* by the Russian botanists, is related to *O. deflexa,* which it resembles in its small flowers and pendulous, stipitate pods. It is a much coarser plant, however, with larger, fewer leaflets, and may be distinguished at once by its ample herbaceous stipules which are connate through nearly half their length opposite the petiole.

EXCLUDED AND IMPERFECTLY KNOWN SPECIES

Oxytropis acuminata Nutt., "Fraser's Catal. No. 58. 1813," reprinted by Greene, Pittonia, 2: 118. 1890, *nom. nud.*

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[19] I am indebted to my friend H. D. Ripley for translating the pertinent keys and descriptions from the Russian.

Described merely as perennial. No doubt Nuttall had in mind *O. Lambertii*, published by Pursh the year following, when already under cultivation in England.

Oxytropis acutirostris (Wats.) Jones, Proc. Calif. Acad. Sci., II, 5:677. 1895. *Spiesia acutirostris* (Wats.) Jones, *loc. cit. nom. provis. Aragallus acutirostris* (Wats.) A. Hell., Catal. N. Amer. Pl., p. 4, 1898.

This is the well known *Astragalus acutirostris* Wats., a desert annual of southern California and adjacent Nevada.

Oxytropis argentata auct.

Listed from Carlton House on the Saskatchewan by Richardson (Append. Frankl. Journ., 745. 1823). Not identified, but certainly neither the Altaic *O. argentata* (Pall.) Pers., nor the species indicated under the same name by Pursh, which is *O. Besseyi* (q. v.)

Oxytropis deflexa var? Port. & Coult., Syn. Fl. Colo., 31. 1874.

This unnamed variety was described from specimens collected by Coulter in the Horseshoe Mts., Colorado. No material with corresponding data has been seen, and the identity of the plant is hence uncertain. It may perhaps be referable to *O. deflexa* var. *deflexa,* which Coulter did collect in Gunnison County.

Oxytropis Lambertii *β* **leucophylla** Nutt. ex T. & G., Fl. N. Amer., 1:339. 1838, in syn.

See next entry.

Oxytropis Lambertii ε T. & G., Fl. N. Amer., 1:339. 1838.

This was quite fully described, but left without a name, Nuttall's var. *β leucophylla* being quoted merely as a synonym; so that the problem of its identity is academic from the nomenclatural point of view. It was based on a plant from "Plains of the Platte," but there seem to be no corresponding specimens either at Philadelphia or in the herbaria of Gray and Torrey. Since it was characterized as "very dwarf, canescently woolly . . . calyx densely woolly," there is an intriguing possibility that Nuttall may have encountered *O. Lagopus* var. *atropurpurea,* fairly common on barren hillsides of the North Platte valley in Wyoming.

Oxytropis Lambertii fma. **vivida** Ckll., Nature Notes (Selborne Soc. Mag.), 2:127. 1891 (1892?).

"West Cliff [Custer County], Colorado, near the waterworks, June 3, 1889." In the absence of specimens with these data it has been impossible to identify the name with assurance. Cockerell cited his new forma as an example of the effect of environment on the color of flowers, claiming that the white-flowered form of *O. Lambertii* (no doubt *O. sericea* var. *sericea* of this paper) was found in "moist, fertile places," and became bright purple when seeding into hotter and drier sites. It is possible that Cockerell had as fma. *vivida* one of the relatively uncommon purple-flowered phases of *O. sericea* (which do not, in the writer's experience, require more xerophytic conditions than the white-flowered form), but more likely it was *O. Lambertii* var. *Bigelovii,* the common Purple Loco of the region. At the time *O. Lambertii* and *O. sericea* were commonly held to be color-forms of one species.

Oxytropis Lambertii fma. **canadensis** Gand., Bull. Soc. Bot. France, 48: xvi. 1901.

Described from plants of southern Manitoba in the valley of the Souris River ("Portage-la-Prairie, *Macmorine, Fowler*"), neither of which has been seen. From lack of significant diagnostic remarks, and from the stated locality, fma *canadensis* can be taken with some assurance to be *O. Lambertii* var. *Lambertii.*

Oxytropis Lambertii fma. **pannosa** Gand., loc. cit., 1901, lapsu **O. pannosa.**"

The binomial "*O. pannosa,*" as taken up by Index Kewensis, was clearly a printer's error, since it was serially numbered as a forma under the preceding. The type was a plant from Fort Collins, Colorado, collected by Crandall. It is probably to be referred to the synonymy of var. *Bigelovii,* common in the foothills about Fort Collins, but the possibility exists that it was purple-flowered *O. sericea.* Crandall made several gatherings of *Oxytropis* in the region, but as Gandoger cited no date or number, it has been impossible to determine whether isotypes exist in this country. But the point is of little interest.

Oxytropis nothoxys (Gray) Jones, Proc. Calif. Acad. Sci. II, 5:677. 1895. *Aragallus nothoxys* (Gray) A. Hell., Catal. N. Amer. Pl., p. 4. 1898.

Better known as *Astragalus nothoxys* Gray.

Oxytropis polaris Seem., Narr. Voy. Herald, 2:24. 1852.

Early and correctly transferred by Bentham to *Astragalus* (Trans. Linn. Soc., 23: 323. 1861).

Oxytropis sordida auct.

Tidestrom (Proc. Biol. Soc. Wash., 50: 18. 1937) listed *Astragalus sordidus* Willd. as American. The original species is a race or variety of *O. campestris* with large, more or less purple-tinted flowers common in high latitudes in Scandinavia east to Novaya Zemlya, but apparently Palearctic only. Bunge long ago pointed out the differences between the Old World plant and that of Labrador *(O. campestris* var. *terrae-novae)* which passed for some years as *O. campestris* var. *sordida;* cf. Fern., Rhodora, 30: 149. 1928.

Oxytropis uralensis auct.

This name was freely used by early authors for any dwarf silky *Oxytropis* with purple flowers, e. g.: Richards. Append. Franklin's Journ., 746—"*Arctic seacoast*" (probably *O. arctica*); Hook., Fl. Bor.-Amer., 1:145; Nutt. Jour. Acad. Philad., 7: 18—"*Wyeth 25.*" These references have not been positively identified. In any case not the well known *O. uralensis* (L.) DC. of the Old World.

Oxytropis uralensis γ **minor** Hook., Fl. Bor.-Amer., 1: 146. 1834: T. & G., Fl. N. Amer., 1: 338. 1838.

This variety was briefly described as "glabriuscula, floribus paucis patulis purpurascentibus," the locality given as "Dry hillsides and prairies of the Rocky Mountains, *Drummond,*" and an additional collection from Labrador referred to it. None of the many specimens of *Oxytropis* sent to Torrey and Gray by Hooker is so labelled or seems to fit the description. The problem is nomenclaturally important in that var. *minor* could prove to be the earliest name in its category for either *O. viscida* var. *hudsonica* or *O. campestris* var. *terrae-novae.* The fact that var. *hudsonica* is glandular does not lessen the probability in the first case, since Hooker had another, even more conspicuously glandular *O. uralensis* var. *subsucculenta.* The Labrador plant mentioned by Hooker can have been nothing else but var. *terrae-novae;* and the recent report of var. *terrae-novae* from northwest Mackenzie makes it possible that the Drummond plant was conspecific after all (cf. discussion of *O. campestris* var. *terrae-novae,* above).

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A PRELIMINARY REPORT ON THE BEHAVIOR OF THE PACIFIC SARDINE *(SARDINOPS CAERULEA)* IN AN ELECTRICAL FIELD

BY

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and NORMAN GRANT*

California Academy of Sciences

Hermann (1885) found that small fish in a direct-current (d.c.) field of a certain density oriented themselves so as to face the anode, or positive pole, and swam toward that pole. When the current was reversed, the fish turned 180° and swam toward the other electrode, the new positive pole. This was confirmed by Blasius and Schweizer (1893), Nagel (1895), Scheminzky (1924), and others.

Since this early work, the galvanotropic reaction of fish has been utilized in this country in the development of electrical fish screens (McMillan, 1929); in the sampling of fresh-water fish populations by Haskell (1939), Haskell and Zilliox (1940), Larimore *et al.* (1950), and by several Canadian workers (Canadian Fish Culturist, 1950); and in studies now being undertaken to develop methods for the elimination of undesirable fresh-water fishes. Success has been reported in the use of electrical methods in commercial fresh-water fisheries in Russia by Chernigin (Anon., 1950) and in Germany by Denzer (1949).

Attention has most recently centered on the possible use of electricity in marine fisheries in Germany by workers utilizing equipment developed by Kreutzer and Peglow, as reported by Houston (1949). Since details of this equipment and the application of its use have not been made generally available, the research reported on below has been undertaken to determine the behavior of the Pacific sardine in an electrical field.

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* This work has been done under the direction of, and with funds provided by, the Marine Research Committee as a part of the California Cooperative Sardine Research Program.

Although this research has been conducted on a laboratory scale thus far, the application of the principles involved to electrical fishing methods in marine fisheries may prove of great value. Such fishing methods may make possible the utilization of so-called "wild" schools of fishes and other marine fishes now difficult to obtain by the use of nets alone.

A wooden tank, 13′ 7½″ long, 20″ wide, and 12″ deep, filled with sea water to a depth of 6 to 7 inches was used (fig. 1). Temperature of the sea water during the course of the experiments varied from 14° C. to 16° C. The water was aerated at all times.

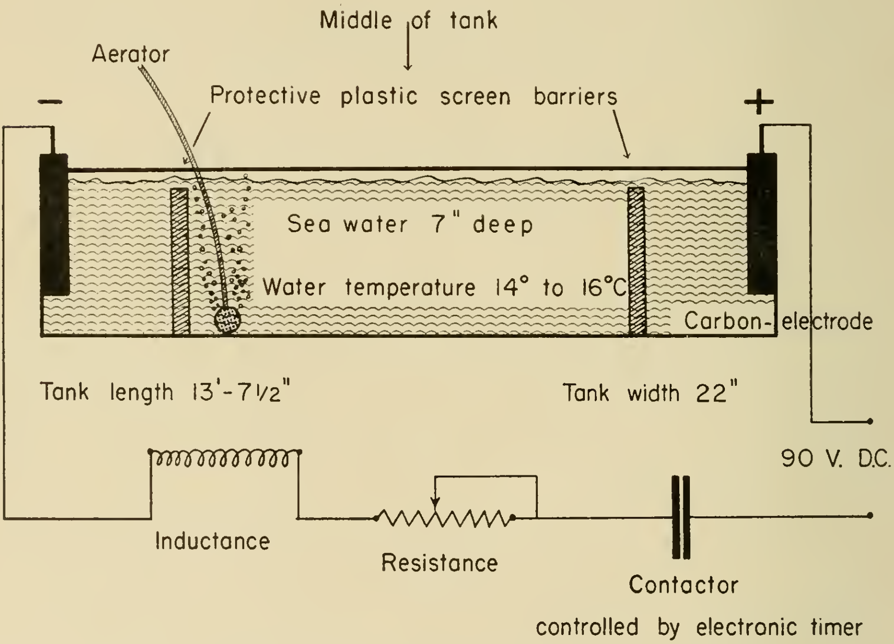

Figure 1. Diagram of experimental tank and electrical circuit.

Carbon electrodes measuring 5″ x 6″ x ¾″ were placed vertically at each end of the tank. Plastic screens were inserted 2 feet in front of each electrode to prevent direct contact with the fish. Pulsating direct current was supplied to the electrodes from a direct-current generator. The amount of current supplied to the tank was controlled by a variable resistor, and the